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FACTORS AFFECTING CHRONICALLY SHORT MILITARY OCCUPATIONAL SKILL (MOS) SPECIALTIES IN USMC RESERVE UNITS

by

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Military Occupational Specialty (MOS) manning levels within Selective Marine Corps Reserve (SMCR) units are of interest to the US Marine Corps (USMC) because of the impact shortages have on unit operational capabilities. The goals of this study are to: 1) identify chronically short MOSs in SMCR units; 2) explore demographic influences on SMCR manning levels; and 3) determine the influence of the Montgomery GI Bill (MGIB) Stipend on SMCR enlistment. The study determines chronically short MOSs using data from the Defense Manpower Data Center and finds MOS shortages are not confined to any particular MOS or geographic region. Using Census Bureau demographic data, the study develops a regression tree to predict demographic influences on regional SMCR unit MOS fill rates. The study identifies several demographic factors correlating to MOS fill rates at the region and state level. Finally, the study compares SMCR unit personnel populations and determines that differences exist in several areas. The USMC should target monetary educational incentives at the RUC level while developing alternative recruitment incentives since educational incentives alone may not produce the desired recruitment in chronically short MOSs in every SMCR unit.

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FACTORS AFFECTING CHRONICALLY SHORT MILITARY OCCUPATIONAL SKILL (MOS) SPECIALTIES IN USMC RESERVE UNITS

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Military Occupational Specialty (MOS) manning levels within Selective Marine Corps Reserve (SMCR) units are of interest to the US Marine Corps (USMC) because of the impact shortages have on unit operational capabilities. The goals of this study are to: 1) identify chronically short MOSs in SMCR units; 2) explore demographic influences on SMCR manning levels; and 3) determine the influence of the Montgomery GI Bill (MGIB) Stipend on SMCR enlistment. The study determines chronically short MOSs using data from the Defense Manpower Data Center and finds MOS shortages are not confined to any particular MOS or geographic region. Using Census Bureau demographic data, the study develops a regression tree to predict demographic influences on regional SMCR unit MOS fill rates. The study identifies several demographic factors correlating to MOS fill rates at the region and state level. Finally, the study compares SMCR unit personnel populations and determines that differences exist in several areas. The USMC should target monetary educational incentives at the RUC level while developing alternative recruitment incentives since educational incentives alone may not produce the desired recruitment in chronically short MOSs in every SMCR unit.

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LIST OF ACRONYMS

CODE	**DEFINITION**
ACF	Army College Fund
AFQT	Armed Forces Qualification Test
AFQTCAT	Armed Forces Qualification Test category
AFQTPER	Armed Forces Qualification Test percentile
ASVAB	Armed Services Vocational Aptitude Battery
BLS	Bureau of Labor and Statistics
BQMA	Black qualified military applicant
DEPNS	number dependents
DMDC	Defense Manpower Data Center
DOD	Department of Defense
EPJ	earnings per job
HQMA	Hispanic qualified military applicant
HQMC	Headquarters Marine Corps
M&RA	Manpower and Reserve Affairs
MARADMIN	Marine administrative notice
MGIB	Montgomery G.I. Bill
MGIBSTAT	Montgomery G.I. Bill status
MOS	military occupational specialty

NPS	non-prior service
PERBPOP	percent Black population
QMA	qualified military applicant
RACETHN	racial background
RCCPDS	Reserve Common Component Personal Data System
RETPTS	retirement points for the last year
RETPTSC	career retirement points
RMIS	Recruit Market Information System
RUC	reporting unit code
SATYRS	satisfactory years of service
SMCR	Selective Marine Corps Reserve
SRB	selective reenlistment bonus
SSN	social security number
T/O	table of organization
TRNCAT	training category
UNEMP	unemployment rate
UNIV	university
USMC	United States Marine Corps
USMCR	United States Marine Corps Reserve
WQMA	White qualified military applicant

YATS	Youth Attitude Tracking Survey
YOS	years of service

EXECUTIVE SUMMARY

In recent years, the Selective Marine Corps Reserve (SMCR) has become an integral component in the total force structure of the US Marine Corps (USMC). With US military force reductions since 1992, the USMC has shifted more war-fighting capability to the Reserve Forces (Brinkley, 1998). Consequently, the USMC needs qualified recruits in order to fill Military Occupational Specialties (MOSs) in each SMCR unit in order to meet operational commitments. Additionally, it is essential the USMC fill undermanned MOSs with new recruits to maintain force readiness.

The recruitment process for the Reserve Forces operates in a unique environment. The military views the recruit as a full-time employee and recruits along traditional lines (Cascio, 1991). However, potential recruits approach the process from a different perspective. Recruits view Reserve Force enlistment as a part-time job decision and follow a moonlighting model (Shishko and Rostker, 1976).

The USMC currently evaluates Reserve Force "health" by personnel end-strength, but does not have a method to identify chronically short MOSs within SMCR units. Numerous studies investigate the influence of demographic factors and monetary educational benefits upon accession or retention, but only at the national or regional level (Goldberg, Greenston & Andrews, 1984; Bock & Moore,

1984; O'Donohue, 1988; Fugita & Lakhani, 1991; Asch & Dertouzos, 1994). While applicable to general military service, the findings are not always applicable to Reserve Force service.

The present study develops a methodology for determining chronically short MOSs in Reporting Unit Codes (RUCs) within the SMCR. It finds numerous MOS shortages across all RUCs without regard to geographic region. These shortages are not confined to any MOS or family of MOSs.

Demographic factors that might account for MOS fill rates throughout the country are considered by concentrating on those that might account for fill rates within an entire region and which might differentiate one region from another. After exploring five broad areas, the study fails to identify any significant factors. RUCs are then grouped by state and after performing a similar analysis on the same factors, the study finds state differences exist and are determined by constructing a regression tree.

Finally, the study explores differences between personnel in a few selected units; infantry weapons companies. The analysis reveals regional and unit differences in several service-related and personal factors. Interestingly, population characteristics are not consistent nationally among similar SMCR units. In fact, some of the differences appear to be regional while others tend to remain at the RUC level.

The study finds that only one region, the Northeast, displays a strong relationship between MOS fill rate and demographic factors. The rest of the regions display trends only at the local level. The study also finds that wide variation exits between RUCs and regions in almost every investigated personal attribute. These results suggest the USMC should target the Montgomery GI Bill (MGIB) Stipend at the MOS RUC level. As an incentive to change to or enlist into a chronically short MOS, the MGIB will be beneficial for Region 2, North-central, and isolated RUCs within the other regions. However, the USMC can develop alternative recruitment incentives for RUCs where educational incentives are not as desirable. In these areas, a monetary incentive will produce better results.

I. INTRODUCTION

A. BACKGROUND

In recent years, the Reserve Forces have become integral components in the United States military establishment (Cohen, 1998). Decreases in end-strength tend to favor the use of the reserves, and Congress continues to support the reserves both in end-strength and funding (Taylor, 1993). As a component of the Reserve Forces, the Selective Marine Corps Reserve (SMCR) is an integral component in the total force structure of the United States Marine Corps (USMC). With the reduction in force of the American military establishment since 1992, the USMC continues to shift more and more war-fighting capability into the Reserves (Brinkley, 1998). Therefore, recruitment to fill the enlisted reserve ranks in order to maintain a force level of 40,000 Marines is of primary concern (Cohen, 1998).

The USMC needs qualified reserve recruits in order to fill specific Military Occupational Specialties (MOSs) which are no longer found in the active duty forces. Additionally, certain operational capabilities have been significantly reduced making the SMCR indispensable in order for the USMC to meet its operational commitments. This thesis explores personnel shortfalls in MOSs and demographic factors that may cause these shortages.

In 1996, Lieutenant General S. E. Ebbesen, Deputy Assistant Secretary of Defense for Military Personnel Policy, and the Honorable A. Bemis, Deputy Assistant Secretary of Defense for Reserve Manpower and Personnel, report to the Sixth Quadrennial Review of Military Compensation that the Montgomery GI Bill (MGIB)

continues to be an important recruiting and retention incentive. Additionally, the RAND Corporation, a private research organization, conducted a series of studies confirming that the MGIB continues to be one of the most important recruiting and retention incentives for the reserve components (Ebbesen and Bemis, 1996). However, the studies also find that the MGIB has, after adjustment for inflation, decreased student tuition coverage from 45% 1986 to 33% in 1994. In light of this decrease in benefits, several services have "Kicker" programs designed to augment the MGIB and increase the amount of college costs covered in selected MOSs at specific reserve units up to an additional supplement of $350.00 per month.

Manpower & Reserve Affairs (M&RA) for Reserve Affairs, Headquarters Marine Corps (HQMC) recently received authorization to begin funding the MBIG Stipend, a supplement to the MGIB, beginning in fiscal year 2000 (FY00). The stipend is equivalent to the "Kicker" programs and will be used to increase recruitment in specific MOS and reserve unit combinations. Qualification criteria are set forth in Marine Administrative Notice (MARADMIN) 148/98. Major Weis, HQMC, M&RA for Reserve Affairs, states that qualified recipients will receive not only the benefits of the MGIB but an additional MGIB supplement each month (Weis, personal communication, October 1998). This stipend is designed as a recruitment tool to recruit qualified college-bound applicants into chronically short MOSs. The service member may use the stipend in conjunction with the MGIB in the pursuit of any program approved in Chapter 30 of 38 United States Code (Department of Defense Instruction 1322.17, 1991).

The USMC Reserve Forces are geographically scattered throughout the United States in company- or battalion/ squadron-size units. Units are not necessarily

geographically co-located with sister units or higher command elements. Each unit has a distinctive reporting unit code (RUC) and a table of organization (T/O). The T/O closely mirrors its active duty counterpart. Recruitment for the MOSs, which comprise the unit's T/O, come from two areas: 1) active duty Marines who have completed their enlistment obligation and 2) 17-23 year old men and women who enter under a reserve enlistment contract. Reserve enlisted Marines must reside within 100 miles of their assigned drill site because travel reimbursement would be required if they travel further than this distance (Asch, 1986). The use of the newly authorized MBIG Stipend is applicable to both groups with emphasis on the second. The objective is to entice new enlistees to enter chronically short MOSs. The following research questions arise as a means of accomplishing this goal:

- Are local area demographics supportive of established unit T/O requirements?
- Are there manning problems for specific MOSs throughout the USMC Reserve Forces?
- Are there RUCs with chronic shortages across all MOSs?

B. RESEARCH OBJECTIVES

The problem confronting M&RA for Reserve Affairs is identifying the type and location of chronically short MOSs within the SMCR. The main purpose of this research is to identify chronically short MOSs, the location of the units possessing those MOSs and possible demographic factors affecting enlistment and retention in these MOSs. The analysis to determine chronically short MOSs uses data resident in the Reserve Common Component Personal Data System (RCCPDS) edit reports for each specific RUC held at the Defense Manpower Data Center (DMDC) and the HQMC T/O for each RUC. The

RCCPDS is a historical database which includes detailed information on a selective reserve member's current assignment, dependency data, initial entry information, personal demographic information, and MGIB eligibility and participation information. The HQMC unit T/O provides a detailed distribution by RUC of each unit's required MOSs by number in each grade.

The second part of the analysis identifies factors causing chronically short MOSs to be undermanned. The analysis considers data resident in the RCCPDS, Youth Attitude Tracking Survey (YATS), Socioeconomic Status (SES), Recruit Market Information System (RMIS), Bureau of Labor Statistics (BLS) and Census Bureau data. The YATS database provides information on 16 to 24 year-old men and women and their propensity to join the military. The SES database provides socioeconomic characteristics of recruit's parents compared against all parents in the general population. The RMIS database provides information on population demographics; annual contracts, accessions, and attritions; prior service military available; and annual YATS information. BLS data provides monthly employment levels by gender and geographic location and quarterly wages paid. Census Bureau data provides general demographic information for a particular geographic location. Finally, the analysis uses the demographic results to determine whether the MGIB Stipend might bring the MOS of interest up to adequate manning levels in the desired geographic location.

The thesis limits data for the analysis to enlisted Marines in the SMCR from fiscal year 1995 to fiscal year 1998. The source for this information is RCCPDS. The study also limits YATS, SES, RMIS, Census Bureau demographic data, and BLS Civilian Employment Report data to those geographic locations of RUCs with identified

chronically short MOSs. DMDC manages RCCPDS, YATS, SES, and RMIS data sources.

In the next chapter, the thesis presents hiring and moonlighting employment theories along with the results of previous studies on demographic influence on personnel manning. Chapter three discusses the methodology used in the analysis. Chapter four details the results of the study's analysis concerning MOS shortages and demographic influences. Finally, the last chapter discusses demographic trends and possible target populations for the MGIB Stipend.

II. LITERATURE REVIEW

Since 1800, the United States' general birth rate has decreased thereby placing the armed forces is direct competition with civilian employers for qualified military available youths (Boisvert & Sumner, 1990). Concurrently, the demand for workers with high technical skills continues to grow thereby placing strains on a finite labor force. Verugo and Berliant (1989) analyze Census Bureau data in an attempt to estimate the potential pool of military recruits. They find that the qualified male population market is declining dramatically and even outpaces the decline in the total youth population. They predict a 21 percent decline in the qualified male population market between 1985 and 1995 compared to a 12 percent general youth population decline that does occur.

This chapter begins by presenting the process for hiring new employees from the viewpoint of the employer. The USMC is looking for new employees to fill the ranks of the Selective Marine Corps Reserve (SMCR). The second section looks at the hiring process from the employee's viewpoint. The current moonlighting model explains motivational factors leading to an individual's decision to enlist into the SMCR as one to take a second job. This section explores those motivational factors and their possible effects on the individuals decision process. Finally, the chapter discusses the effect demographic factors may have on the individual's decision to enlist and their role in predicting reserve accession and retention.

A. EMPLOYER ACTIONS IN THE HIRING PROCESS

"Hiring practices should be consistent with organizational needs. Accurately assessing staffing requirements is difficult yet important. Over- or under-hiring can have

serious implications for firm performance." (Larkin, 1995) The firm must view the hiring of employees with the same financial and strategic perspective it views capital investment and not as just a short-term expense. In fact, hiring an $80,000 per year employee can translate into a $1 million investment for the firm over a ten-year period (National Petroleum News, 1995). Therefore, the employer needs to prosecute the hiring process in a clear, concise, and systematic way in order to minimize disruption to the firm while maximizing the firm's productivity.

Cascio (1991) advises the firm to perform several tasks in planning for recruitment including:

1. Establish human resource plans;
2. Specify time, cost, and staff requirements;
3. Analyze employment sources;
4. Determine and validate job requirements and employment standards.

Recruitment is a two-way process between the employer and employee who seek each other out. Because of this "seeking-out" strategy, there must be a common communication medium: the prospective employee must perceive a match between himself and the firm, and he must want the job to such a degree that he is willing to apply for the position. The firm is then responsible for creating an atmosphere that solicits the desired response from perspective employees.

The firm must estimate the time, the money, and staff required to achieve the desired hiring rate for the company. In order to determine these parameters, the firm needs to identify one basic statistic: the number of leads required to generate a successful hire in the designated time with the appropriate qualification level (Cascio, 1991). Hawk

(1967) develops a "recruit yield pyramid" as a generic recruiting plan for firms to follow when hiring new recruits for the firm. Cascio (1991) validates the formulation of the pyramid which looks at the number of leads, invites, interviews, and offers needed to generate one hire. In his example, 100 hires require 2400 leads. Both seek to provide an encapsulation of the recruiting problem and to suggest areas requiring further exploration before beginning the recruitment and hiring process.

The company's hiring process is further complicated by a number of external factors. The firm must analyze the local external labor market and evaluate such items as geographic factors, location, cost of living, competitors' demand for the local work force, and local community support (Cascio, 1991). Once the firm determines that the local community can support the desired hiring, it must analyze recruiting sources in order to enhance effective recruitment planning. Hawk (1967) and Cascio (1991) identify three types of required analysis: cost-per-hire, time lapse from employee identification to hire, and source yield. The source yield, the most critical of the three, is the ratio of the number of prospective employees generated from a given source to the number of hires from that source. This evaluation is invaluable for determining how effective hiring time is spent within the local labor market (Cascio, 1991). Both authors emphasize that the information contained in the recruitment advertisement is of prime importance. A firm following this hiring methodology can successfully compete in the local market place for the employees it needs in order to attain its desired operational goals.

The USMC recruits for the SMCR by applying the principles listed above. The USMC views members of the SMCR as full-time employees since they have the potential for being called to active duty for an indefinite period of time at a moment's notice.

Therefore, the USMC is concerned with putting the right recruit into the right MOS. To that end, the USMC develops criteria for each MOS to ensure each member of a MOS contains the raw skills and abilities to be successful.

The USMC uses the methodology of Marvin (1973) to place the right recruit into the right MOS by using three inputs: "position profiles, prospects, and prospect profiles." Position profiles state company performance expectations by experience for each position. The USMC defines position profiles by use of the Military Occupational Specialties Manual. The manual specifies the educational requirements for each MOS and service schools required for assignment (HQMC MOS Manual, 1993).

Prospects are the recruits seeking employment with the firm (Marvin, 1993). The USMC seeks prospects through a national recruiting command that uses predicted MOS shortages and enlistment incentives such as the MGIB to place recruits into the desired MOS. Finally, prospect profiles are biographical performance sketches of the employee seeking the new position (Marvin, 1973). These profiles are ascertained by testing the prospective recruit and maintaining the results in a personnel database. The recruit is aware of performance expectations from the beginning, and the testing matches the right recruit to the right MOS (Larkin, 1995; HQMC MOS Manual, 1993).

The USMC hires according to the theoretical procedures outlined by Marvin (1973) and generally places the right recruit into the right MOS. However, the USMC has trouble evaluating the local labor market in adherence to Cascio's work. Currently, the USMC is unable to determine if the labor market can support the reserve unit's manning requirements; in some cases it cannot, leading to chronically short MOSs at some commands (Weis, undated; Weis, 1998).

B. MOONLIGHTING MARKET THEORY

While the USMC views enlistees as full-time employees, the individual views a decision to enlist in the SMCR as that of taking a second job or "moonlighting." Reservists are often considered multiple job-holders or "moonlighters" because most of them concurrently hold a primary job in the civilian labor market (O'Donohue, 1988). The economic model that best describes the actions of the enlistees is the moonlighting model put forth by Shishko and Rostker (1976).

1. The Shishko and Rostker Moonlighting Model

The Reserve Forces compete in the labor market with civilian firms in an attempt to fill the reserve ranks. Since the typical reservist only works on average one weekend a month and two weeks during the summer, the reservist usually must have a primary job in the civilian market, and reserve participation is particularly appealing for the individual looking for a second job. The Reserve Forces must offer pecuniary and non-pecuniary compensation benefits to entice the reservist to forgo the leisure time he must sacrifice in order to be a member of the organization (O'Donohue, 1988; Holzberger, 1986).

In the Shishko and Rostker model (1976), the moonlighter is an individual who adjusts the number of hours he works in order to optimize the trade-off between leisure and work hours. The moonlighter is locked into a primary job but seeks secondary employment in order to achieve a higher income level or satisfy psychological needs by becoming a member of the organization (O'Donohue, 1988). Shishko and Rostker (1976) also identify four principle factors that entice an individual to moonlight or take a secondary job. The four variables that affect the number of secondary job hours that an

individual works are: 1) the number of primary job hours; 2) the primary job wage rate; 3) the secondary job wage rate; and 4) non-labor income. They test their model using probit regression on civilian data from the University of Michigan Income Dynamics Panel.

Shishko and Rostker (1976) find that one of the most important explanatory variables in estimating the moonlighting supply function is the wage received on the moonlighting job. As the secondary wage rate increases, the propensity to increase moonlighting hours increases. Additionally, they discover that for every 10 percent increase in the secondary job rate, the probability an individual will moonlight increases by nine percent. The model also finds that increasing age reduces the propensity to moonlight while increasing family size increases it.

Grissmer and Kirby (1985) identify a number of differences between the civilian moonlighter and the reservist. Some of their findings are:

1. A reservist works on average four hours a week while the average civilian moonlighter works 13 hours a week.

2. While reservists and moonlighters are paid about the same hourly rate, reservists receive much less total income because of the reduced number of hours they work.

3. Reservists legally obligate themselves for up to six years of service during which they can be activated at any time. The civilian moonlighter has no comparable obligation.

4. Reservists are eligible for non-pecuniary benefits such as the MGIB and retirement that are not normally found in the civilian moonlighting job.

5. Reserve duty time and primary job time may directly conflict especially during the annual two-week active duty training period.

6. Reserves receive non-pecuniary benefits such as specialized training, unit associated camaraderie, and satisfaction from serving one's country that the civilian moonlighter does not normally receive.

Therefore, the Shishko and Rostker model may not fully explain moonlighting propensity in joining the Reserve Forces but may require modification when dealing with the reserves.

2. The Moonlighting Decision

Hamel (1967) does some early investigative work into primary motivational factors on the decision to moonlight in the civilian job market. Using Division of Labor Force Studies from the Bureau of Labor Statistics, he finds that among men who are the heads of households, there is a direct and close relationship between multiple job holding rates, the size of the household, and the primary job weekly earnings. Moonlighting tendency decreases as primary job rates increase and increases as family unit size increases. He also finds the majority of the moonlighters are men with the highest number between the ages of 25 and 44. Moonlighting is least likely among younger single men. Hamel (1967) finds the typical moonlighter to be:

> ...a highly motivated and energetic young married man with a growing family, who works at two jobs or more primarily to provide additional income for his family but also for a variety of other reasons: to try his hand at working for himself; to keep busy; to obtain satisfaction; to experiment with another line of work; or to supply skills that are in demand in his community. The moonlighter aspires to a better living and is willing to work hard to obtain his goal.

Perlman (1966) investigates motivation factors affecting a worker's decision to moonlight. He finds the employee who decides to moonlight is not expected to work at a significantly lower pay rate on the second job than on the primary job. Moonlighter psychology describes multiple job-holders as workers who view consumption pressures and aspirations as greatly exceeding the economic benefits of their primary job. He also finds that an increase in the number of underemployed hours, fewer employment hours

than he considers optimal, as wages rise leads to more moonlighting among affected workers.

Amirault (1995, 1996 & 1997) reevaluates Hamel's findings using the 1995 Current Population Survey and finds some remarkable demographic shifts in the moonlighting workforce. He primarily looks at educational attainment, earnings, occupations, and primary job industries of employment to explain moonlighting rates. He finds the tendency to moonlight increases with education at all levels with the exception of those with professional degrees (physicians and lawyers). He also finds moonlighting worker percentages decline only slightly as primary job earnings increase. He theorizes this trend results because well-paid workers have primary jobs that permit more work-hour flexibility or because they seek greater income levels. He also finds workers holding primary jobs in the professional, technical, and service occupations are the most likely to hold a secondary job.

Researchers apply the Shishko and Rostker model to the civilian labor market in an attempt to determine additional factors that might affect the primary job-holder's decision to moonlight. Krishman (1990) develops a self-selection model of moonlighting. Her model explores a husband's decision to moonlight in conjunction with his wife's decision to work. The model looks at 4,448 couples from the Survey of Income and Program Participation, Wave 2. She eliminates households who are in the armed forces, self-employed, or who work as unpaid family labor. Her results indicate that increased participation by wives working, working longer hours and higher income on the first job all deter moonlighting. A surprising result is that large amounts of specific skills inherent in the worker also deter moonlighting but increase the worker's

expected wages in the secondary job. She also shows that as family income increases the probability to moonlight decreases. Finally, she finds general worker skills do not affect wages on the job but do encourage moonlighting participation.

Allen (1998) investigates moonlighting behavior among unmarried men and women, including unmarried parents. Using logit regression, his analysis considers 1,537 unmarried heads of households from the 1987 version of the University of Michigan Panel Study of Income Dynamics. His findings suggest that a larger immediate and extended family will lessen the probability that an unmarried individual will tend to moonlight. For a single female parent, a greater number of small children under five years of age reduce the probability of moonlighting. While still a factor for men, this variable is not statistically significant. This same factor is statistically insignificant in Krishman's (1990) study of married couples. As the number of children in this age group increases, the parent has less time to moonlight. Allen also finds that unmarried women in the youngest age groups are the most likely to moonlight which contrasts with unmarried men, whose propensity to moonlight remains fairly constant over all age groups. Finally, the effects of wealth and income exert no affect on the probability of an individual to moonlight.

Tan (1991) explores the effects of demographic and macro-economic variables and policy instruments on the supply of non-prior service (NPS) reserve personnel. He predicts a greater likelihood towards reserve enlistment in local labor markets where the civilian wage rate is low and reserve pay relatively high, and a lower likelihood in markets where family income is high or long hours and overtime in the primary job constrain moonlighting. He finds a lower propensity to enlist in the reserves in large

urban labor markets where alternative civilian moonlighting opportunities are abundant. In general, NPS enlistments in the reserves are higher when unemployment rates and the size of the qualified military applicant youth population are high and lower in highly urbanized local labor markets.

C. ACCESSION/RETENTION FACTORS

The prime recruiting market for military service consists of males age 17-21 who are not institutionalized, are medically and morally qualified, are not currently serving in the military, are not in college, score in the upper half of the Armed Services Vocational Aptitude Battery (ASVAB), and are high school graduates (Verdugo and Berliant, 1989). The armed services use a number of recruiting incentives to entice this target population to commit to a four to six year military service obligation. Stephens (1977) finds that reservists value the non-pecuniary benefits of their jobs more highly than their civilian counterparts, and group membership and liking for the military environment play significant roles in their decision to join and remain in the reserves. These incentives result from extensive research into demographic and personal factors within the population that affect the accession and retention of recruits for both the active and reserve forces. The factors include the effects of demographic, macro- and micro-economic, and personal variables on the decision to enlist or remain in the military establishment. A review of applicable studies follows.

1. The 1970s and 1980s

Mobley, Griffith and Hand (1977) conduct a study to explore positive factors that affect an individual's decision to enlist. They find job training, educational benefits, peer and parent influence, maturity and financial security are all factors leading to a recruit's

positive decision to enlist. They also discover several factors that entice an individual not to enlist. These factors are an individual's desire to finish his education, the sense of a loss of freedom, pressure by the recruited to join and pressure by peers not to join.

Goldberg, Greenston, and Andrews (1984) conduct an exploratory study to estimate Army enlistment supply of ten DOD one-digit occupational codes. These codes closely correspond to the USMC use of MOS codes that indicate a particular job within the armed services. They discover that military pay, unemployment and the number of recruiters all have positive impact on the number of new recruits. They further discover that bonuses and educational benefits are able to channel new enlistees into targeted MOSs but do not increase the supply of enlistees. Finally, the authors find that a high Black population in a geographical location has a negative effect on high-quality enlistments. For each one-percent increase of Blacks in the total population, enlistments decline by 9.5 percent.

Bock and Moore (1984) analyze Armed Services Vocational Aptitude Battery (ASVAB) test performance of subjects against their background characteristics. This study is of particular interest since ASVAB testing often determines a recruit's military job assignment. They evaluate the specific characteristics age, sex, geographical residence region, socio-cultural group membership, economic status, education level, and mother's education. The analysis reveals that the individual's education and economic status has a direct positive correlation to test results. Blacks score consistently below Whites and Hispanics on all tests and at all grade levels and economic classes. Additionally, Whites and non-poor groups perform much better in topics that require school as the primary learning mechanism with the gap in performance increasing with

the number of school years. Smaller differences in test performances remain constant throughout all grade levels on topics that are less tied to formal learning but are more a part of daily experience in and out of school.

Bock and Moore (1984) also look at test result differences by region. The authors divide the country into four regions: Northeast, Southeast, Midwest and West. They discover that Blacks and Whites in the Northeast perform slightly better than their counterparts elsewhere in the country followed by the Midwest, West and Southeast. The Northeast has higher scores in academic subjects while the West has higher scores in auto and shop information and mechanical comprehension. Finally, Hispanics from the Southeast and Midwest perform at the same levels as non-poor Whites in all subjects. They also consider the mother's education level as an indication of a family's contribution to the child's education. They find a strong and direct association with test performance especially in areas dependent on language and instruction; a mother's education has less impact on tests not strongly tied to formal education.

Brown (1984) explores the effects of pay, unemployment, educational benefits and recruiting resources on active duty military enlistments in the Army from 1976 to 1982. His results demonstrate that a 10 percent increase in pay increases the supply of potential enlistees by 10 percent. He also finds that a 10 percent increase in the unemployment rate increases the number of high-quality enlistees by six percent. He finds no significant correlation between educational benefits and recruiting resources and their effect on enlistee availability.

Goldberg (1985) provides new estimates on the effect of unemployment on enlisted retention. Generally, he finds that as unemployment increases, the first-term re-

enlistment rate also increases. The study further investigates the effects of varying unemployment on nine rating groups or MOSs and finds varying effects on the groups for a particular unemployment rate; the unemployment rate affects the ability to recruit for a specific MOS. He also finds that pay elasticities are three to five times larger than unemployment elasticities indicating a decrease in the unemployment rate may be offset by a much smaller increase in military pay for active duty members.

Pliske, Elig and Johnson (1986) conduct a new active duty recruit survey from 1982 to 1983 to study motivation patterns for enlisting. They are able to identify six factor categories that account for the recruit's decision to enlist. The factors are:

1. Self improvement – self betterment, leadership and physical training;
2. Economic – money, skill training, desire for a better job;
3. Military service – patriotic duty, retirement and fringe benefits;
4. Time out – escape the current situation, join friends, family tradition;
5. Travel – see the world, leave home;
6. Education money – money for college or vocational/technical school.

They further find that high mental category recruits have a large positive factor score for educational benefits so that programs such as the MGIB can be expected to have a higher influence on their decision to enlist.

Antel, Hosek and Peterson (1987) study military enlistment and attrition. The study's results show a negative relationship between an individual's academic ability, educational finances (money for college) and employment opportunities and their propensity to enlist. Education variables are more important for high school graduates. Additionally, wage and job tenure variables relate negatively to enlistment propensity for

graduates. The lower the tenure and the lower the wage, the more likely the individual is to enlist.

O'Donohue (1988) examines factors influencing male, first-term enlisted SMCR reservist's reenlistment decisions. He develops a non-prior service retention model using logit regression to explain the reenlistment decision. He identifies several significant demographic variables that account for the reenlistment decision. Those variables are:

1. Age – retention increases four percent with every year increase in age;
2. Family – the larger the service member's family, the less likely he is to reenlist.

He also finds that high school graduates retain at a higher rate than non-high school graduates and that those with some college are even more likely to reenlist. He also discovers that sergeants and above retain at a higher rate, and those service members who receive a bonus in their current rate also have higher retention. Finally, he finds that reserve income has a positive relationship to retention and actually has a large impact.

Fithian (1988) also looks at male first-term enlistee retention in the reserves and Air National Guard. Using logit regression, he investigates the relative importance of various demographic, military experience and perceptual factors in the retention decision. He finds a positive effect across all groups of the married demographic variable in making a positive reenlistment decision. Education is not significant but tends to have a negative effect on non-high school or GED graduates and the college educated who are less likely to reenlist. The number of dependents tends to have a positive retention effect (i.e. the more dependents the service member has the more likely he is to reenlist). Race and ethnicity are not significant but Blacks are less likely to stay than Whites while other

minorities demonstrate a higher propensity to reenlist than Whites. Finally, pecuniary benefits are not significant and do not significantly contribute to the retention decision.

2. The 1990s

Fugita and Lakhani (1991) conduct a study that samples 7,525 reserve officers and 29,783 reserve enlisted in order to estimate retention intentions. Their results find that military earnings are positively related to retention. An increase of $1,000 in earnings increases retention probability by 16 percent. Conversely, they also discover that a $1,000 increase in civilian wages result in a decrease of one percent in probability of reserve retention. They also find an individual's propensity to re-enlist increases with an increase in his military seniority. Finally, they measure the effect of a spouse's attitude on the re-enlistment decision. Using a five-point scale, they find an increase of one-point on their survey results in a 26 percent increase in the likelihood of re-enlisting.

Queser and Adedeji (1991) analyze the re-enlistment decision of 27,000 active duty Marines from fiscal year 1980 until fiscal year 1990. One of the areas they explore is the effect of the selective re-enlistment bonus (SRB) multiplier; a monetary incentive to re-enlist. They find SRBs exert a strong impact on the re-enlistment decision and for each increase in the bonus award level, there is a six- percent increase in the re-enlistment rate. In this study, the first term re-enlistment decision is very similar to the initial enlistment decision. They also find a positive correlation between an increasing unemployment rate and the positive decision to re-enlist.

Asch and Dertouzos (1994) analyze the relative cost effectiveness of enlistment bonuses and educational benefits for inducing enlistment. They study several cohorts of high quality recruits from the National Guard and Army Reserve between 1982 and 1984

in order to determine the success of the enlistment bonus experiment. The results indicate bonuses have a noticeable channeling effect towards targeted MOSs and are successful in increasing the number re-enlistments. Educational benefits also display a channeling effect but not to the same degree as bonuses do. The education bonus increases enlistment contract completion but tends to reduce retention since those receiving the bonus tend to continue their education. The analysis shows educational benefits compare favorably with alternative recruiting resource options and increase high quality enlistments.

Gee and Nelson (1995) study the difference in participation and usage behavior of individuals using the MGIB and the Army College Fund (ACF). The study uses probit regression linking the benefits offered to demographic factors, education level at time of entry and the Armed Forces Qualification Test (AFQT) category. The study finds that high school graduates participate in education programs at a much higher rate. Married veterans, Blacks and veterans in AFQT category IIIA are less likely to use the benefits than unmarried veterans, Whites and veterans in AFQT categories I and II. Additionally, as the enlistee's education level increases, ACF participation decreases. High school graduates have the highest participation rates and use their educational benefits to obtain an undergraduate education.

Moore, Griffis and Cavalluzzo (1996) develop a retention model for second-term enlistment decisions by Navy enlisted. They find that all else being equal, women are more likely to re-enlist or extend than men. The individual's marital status is significant in the decision process. Married women are more likely to leave than married men, and unmarried women are more likely to stay than their male counterparts. Additionally,

single parents are more likely to stay than married parents--possibly due to the need for additional income. Minorities and individuals without a high school degree are less likely to re-enlist. Additionally, the older reservist and the reservist in higher pay-grades are more likely to re-enlist. Finally, the higher the individual's AFQT score the greater the probability of re-enlistment.

D. SUMMARY

The recruitment process for the Reserve Forces operates in a unique environment. The military views the prospective recruit as a full-time employee who may have to go on active duty at any moment. The recruiting establishment approaches recruitment along traditional lines and closely follows a process put forward by Cascio (1991). Generally, the services are successful in meeting the personnel requirements set forth by the Department of Defense.

The prospective recruit approaches the recruitment process from a completely different direction. The perspective enlistee views the reserves as a part-time job. Shishko's and Rostker's (1976) moonlighting model explains his enlistment decision. While the model originally explains employee actions in the civilian labor market, work by H.W. Tan in 1991 demonstrates its relevance to the military enlistment scenario.

Numerous studies throughout the 1980s and 1990s attempt to discover factors that influence the enlistment and retention decision. Most of the studies investigate the effects of demographic, macro- and micro-economic, and personal variables on the decision to enlist or remain in the military establishment. After considering all of the studies, a high-yield reserve market will have the following characteristics (Holzberger, 1986):

1. High proportion of qualified military available youth in the population;
2. Relatively low proportion of Blacks;
3. Relatively high levels of income and general affluence;
4. Low proportion of families with dual workers;
5. Large family size.

One drawback of all of the studies is their tendency to focus on reserve and active duty accession and retention at the national level. Because of the unique requirement that drilling reservists reside within 100 miles of their drilling unit, the current models may not be completely applicable. Reserve enlistment operates not only in the national labor market but also and more importantly in the local labor market (Daula and Smith, 1984). Therefore, local demographic factors exert considerable affects on the number and type of enlistments in the Reserve Forces. In order to be accurate, reserve supply studies need to evaluate job markets at the lowest geographic level possible.

The literature indicates that community unemployment rates, population age, income level, local labor market environment, community racial makeup, and education level affect military enlistment rates at the national level. These factors might also influence military enlistments at the local level but possibly not in the same priority nor to the same degree of significance. These factors serve as a point of departure to answer the question: Are local area demographics supportive of established unit T/O requirements?

M&RA for Reserve Affairs has authorization to provide a stipend to the MGIB to guide enlistments into chronically short MOSs. Unfortunately, the USMC does not know which MOSs or geographic locations to target this new enlistment incentive. This

research identifies the MOSs in the SMCR that are currently chronically short and also identifies local and national demographic and economic variables affecting their manning level that the RUC MOS fill rate reflects.

III. METHODS

A. CHRONICALLY SHORT MILITARY OCCUPATIONAL SPECIALTIES

1. Reserve Common Component Personal Data System

The Defense Manpower Data Center (DMDC) maintains the Reserve Common Component Personal Data System (RCCPDS) database. The database contains personal information on all current and former members of the US Reserve Forces and since 1975, is the official source for Reserve Force strength data. The database contains 102 data elements on each individual; indexing records by social security number (DMDC Profile, 1998). The RCCPDS contains detailed individual data including the service member's current assignment, military advancement information, Military Occupational Specialty (MOS) information, dependency data, initial entry information, personal demographic information, and promotion and Montgomery GI Bill (MGIB) eligibility and usage information.

2. Data Extraction

The US Marine Corps (USMC) DMDC liaison provides monthly personnel transaction files from each active Reporting Unit Code (RUC) in the USMC Reserve Force from October 1994 to September 1998. Each monthly file contains 54 data fields on each active drilling Marine in the Selective Marine Corps Reserve (SMCR) and consists of approximately 30,000 Marines.

In determining chronically short MOSs within a RUC, the analysis uses three data fields: 1) social security number for individual identification; 2) duty MOS that indicates the Marine's MOS; and 3) pay grade, which indicates the Marine's rank. These files are

analyzed by month to determine shortages within each RUC. Headquarters Marine Corps (HQMC), Manpower and Reserve Affairs (M&RA) for Reserve Affairs provides a database of currently active RUCs with each unit's associated Table of Organization (T/O). The T/O specifies MOS authorization by rank for each RUC's manning level. HQMC, Washington D.C., maintains all RUC T/Os and is the approving agency for T/O changes.

3. Identifying Chronically Short MOSs

Whether a particular MOS is short depends on the number of Marines assigned to the unit possessing that MOS and the Marines' ranks. After detailed discussions with Major Weis, M&RA for Reserve Affairs, the analysis uses the following rule for evaluating unit manning levels: a manning requirement for a particular MOS in any unit is satisfied only by a Marine possessing the required MOS, school trained in the MOS, and two ranks below or one rank above the grade requirement for the MOS. For example, if the unit's T/O authorizes the MOS 0231, intelligence clerk, in the rank of sergeant, the unit can fill the position with an individual with a rank between Lance Corporal and Staff Sergeant with a MOS of 0231.

The study establishes a level of 70 percent as the minimum manning level; therefore units failing to meet that level in a particular MOS are labeled as "short" in that MOS for that month (Weiss, personal conversation, December 1998). Additionally, the analysis requires MOSs to match exactly so that an individual in a related MOS can not fill an MOS that is under-manned. Likewise, an individual with a particular MOS but who falls outside of the established rank limits can not fill a billet requirement for that MOS.

The RCCPDS database, the actual on-hand strength report for the RUC, is compared to the RUC's T/O to determine if the RUC is "short" in that MOS for that month. After determining a RUC's manning level status each month for each MOS, the study classifies the RUC as "chronically short" in that MOS if it fails to reach the established manning level more than 70 percent of the time over the 48-month period. Finally, the analysis computes the overall fill percentage of the RUC's authorized MOSs. The number of MOSs that meet the 70 percent manning level for the 48 month period are divided by the number of authorized MOSs in order to determine the unit's overall personnel manning level. The analysis considers all 269 RUCs in the USMC Reserve Forces in the determination of chronically short MOSs.

B. DEMOGRAPHIC INFLUENCE ANALYSIS

1. RUC Selection

In analyzing the influence of demographic and socioeconomic influences on MOS manning levels at each RUC, the analysis initially considers all 269 RUCs. In accordance with the Youth Attitude Tracking Survey (YATS) regional breakdown of the US into Northeast, South, West, and North-central regions, the RUCs are grouped by region and then by state to include the District of Columbia (DC). States belonging to the specific YATS regions are given in Table 1.

Table 1. YATS Region Associated States

REGION	STATES
1 (Northeast)	CT,DC,DE,MA,ME,NH,NJ,NY,PA,RI,VT
2 (North-central)	IA,IL,IN,KS,KY,MI,MN,MO,ND,NE,OH,SD,WI
3 (South)	AL,AR,FL,GA,LA,MD,MS,NC,OK,SC,TN,TX,VA,WV
4 (West)	AK,AZ,CA,CO,HI,ID,MT,NM,NV,OR,UT,WA,WY

The RUCs of a particular state are then collapsed into a single grouping to provide a MOS fill rate for the state. For example, assume the state of Iowa contains two RUCs. RUC A is authorized six MOSs and is chronically short in three while RUC B is authorized eight MOSs and is chronically short in three. The state as a whole is then authorized 14 MOSs and satisfactorily fills eight for a state MOS fill rate of 57.14 percent. The analysis uses these state MOS fill rates to explore demographic influences on MOS manning levels by YATS regions.

2. Demographic and Socioeconomic Indicators

Demographic and socioeconomic data is obtained from the US Government Census Bureau database. The DMDC provides regional estimates of youth attitudes towards joining the military from the YATS database and estimates the number of Qualified Military Applicants (QMA) between the ages of 17 to 21 years from the Recruit Market Information System (RMIS) database for the geographic locations of interest. The study investigates five broad areas of interest: 1) unemployment rates; 2) population density; 3) educational and racial background of the local enlistment-eligible population; 4) the local community's and enlistment-eligible population's attitude towards military service; and 5) the community's overall economic situation.

Although unemployment data has been explored as an indicator to predict enlistment supply, studies tend to focus on unemployment at the national level (Goldberg, Greenston, & Andrews, 1984; Brown, 1984; Goldberg, 1985; Fugita & Lakhani, 1991). The analysis uses state level unemployment figures while using the same approach in gathering population density and racial background data for the state's enlistment eligible

population. Of particular interest is the size and racial makeup of the prime enlistment age group, 18 to 24 year olds.

The research only considers the male population since the USMC historically recruits only three to five percent women for the reserve force (Weiss, personal conversation, Dec 1998). The state population levels do not quite match up with the RUC location. RUCs within 100 miles of the state's border can draw upon a portion of the adjoining state's enlistment-eligible population. Additionally, RUCs in the larger Western states can not draw on the entire state population, but the RUCs within a state usually cover the entire state making the figure a reasonable estimate.

The analysis uses the number of veterans, active duty military, active duty military dependents and Department of Defense civilian workers to try an get an indication of the state's attitude towards military service. The enlistment-eligible population's attitude towards military service will be more favorable where these groups make up a larger proportion of the community's population (Pliske, Elig & Johnson, 1986). The YATS data is a direct indicator of the target population's propensity to favorably consider military enlistment in the reserves.

DMDC compiles YATS data annually. The study estimates minority regional data using minority national data and white regional and national data. DMDC does not calculate regional minority YATS data because the sample sizes are too small to show statistical significance (Shoenlin, personal communications, February 1999).

The economic makeup of the local community is captured by household size, earnings per job, per capita income and disposable per capita income, and median household income. According to the moonlighting theory, as income increases the

positive propensity to join the Reserve Forces decreases. The United States Census Bureau and Bureau of Labor and Statistics supplies all economic data.

3. Analysis

Previous research uses logistic regression to determine the effect demographic and educational factors have on military enlistment supply (Bock & Moore, 1984; Brown, 1984; O'Donohue, 1988; Fithian, 1988; Fugita & Lakhani, 1991; Tan, 1991; Moore, Griffis & Cavalluzzo, 1996). The current analysis identifies regional factors that might explain differences in RUC manning levels. The dependent variable is the MOS fill rate for the state, and the goal is to find factors that account for the observed manning levels.

In contrast to previous studies, the analysis starts with the entire data set in order to identify factors influencing the unit's manning level. The initial step plots the various variables of interest against the MOS percent fill rate in order to determine possible predictors. After identifying possible demographic factors through graphical analysis, the study uses exploratory data reduction techniques to reduce the field of demographic factors.

Regression trees are used to discover structure within the data. Regression trees are a non-parametric regression technique that can model either numerical or categorical dependent and independent variables. The result is a regression tree consisting of terminal nodes, "leaves", that contain groups of cases with similar values of the independent variables and estimates the most likely value of the dependent variable (Venables & Ripley, 1994).

Regression trees begin with a parent node that contains the entire data set's records. The deviance in that node determines how to partition the node. Let y_j; j = 1,..., n be the values of the dependent variable of a sample of size n, then the deviance for regression trees with I nodes is:

$$Deviance = \sum_{i}^{I} \sum_{y_j \in node(i)} \left(y_j - \bar{y}_i\right)^2$$

where node(i); i = 1,...,I is a partition of the integers 1,...,n which defines the membership of the nodes and $\bar{y}_i$ is the average of the dependent variables in node(i). At each step, a regression tree algorithm looks at every independent variable and all possible binary splits within the independent variable; selects the variable and split which produces the maximum reduction in deviance; and then splits the node into two subordinate or "child" nodes. The two subordinate nodes' cumulative deviance will not be larger than the parent's deviance. The procedure repeats itself until it is infeasible to continue (Venables & Ripley, 1994). Because of the small data set, this study uses the regression tree as a method to identify demographic and socioeconomic factors and to determine significant independent variables that account for regional differences.

C. INTERNAL RUC PERSONNEL ANALYSIS

The study concludes by analyzing personnel within RUCs to determine if differences exist between RUC populations in different geographic locations and between YATS regions. The identification of personal differences leads to a prediction as to whether the MGIB Stipend will be a viable enlistment incentive for increasing manning levels in chronically short MOSs. For this stage of the analysis, the study selects all weapons companies from the SMCR.

The analysis uses data from the DMDC RCCPDS database. The database contains personal data on all past and present members of the Reserve Forces. Each personal record contains a number of data elements that reserve units report monthly to DMDC. Data includes personal ethnic and educational information; MOS, length of service, military test scores and type of service related information; and MGIB information. The analysis uses the Pearson's chi-square test for independence to determine if personnel in individual RUCs within a YATS region or the YATS regions themselves are different in the demographic factors of interest.

IV. RESULTS

A. CHRONICALLY SHORT MILITARY OCCUPATIONAL SPECIALTIES ANALYSIS

1. Goals and Data Source

The initial portion of the analysis identifies the enlisted Military Occupational Specialties (MOSs) in the US Marine Corps (USMC) Reserve Forces that are chronically short over the last four years. Currently, Headquarters, USMC (USMC) Manpower and Reserve Affairs (M&RA) for Reserve Affairs suspects certain enlisted MOSs are chronically short but is not definitively aware which ones they are nor at which geographic locations they are found (Weis, personal conversation, December 1998). The analysis uses the Selective Marine Corps Reserve (SMCR) Reserve Common Component Personal Data System (RCCPDS) databases from the Defense Manpower Data Center (DMDC).

The analysis uses four data fields from the monthly database files. These fields are rank, social security number (SSN), the primary MOS and the Marine's assigned Reporting Unit Code (RUC) number for every active drilling enlisted SMCR member. The analysis uses the individual's SSN in order to avoid double-counting the Marine during the initial database construction from DMDC. Additionally, the analysis uses the Marine's rank, primary MOS and assigned RUC number in order to compare the unit's on-hand strength against the unit's authorized Table of Organization (T/O). Appendix A outlines all data fields the analysis uses.

Appendix B contains the functions developed for the analysis. The heart of the chronically short MOS analysis lies in the ChronicCompare function. A RUC receives credit for meeting the manning level requirements in a month if it achieves a 70 percent

fill rate during that month. A required billet can only be filled by a Marine who is school-trained in the required MOS and possesses a rank no more than one above nor less than two below the rank designated in the unit's T/O. The analysis designates the MOS for that RUC as chronically short if it fails to fill that MOS to 70 percent or more of its requirement 70 percent of the time. HQMC, M&RA for Reserve Affairs supplies all T/O's for the RUCs of interest.

2. Results

While the SMCR continually achieves personnel end-strength requirements, the analysis finds the vast majority of the RUCs are well below a 50 percent fill rate for their authorized MOSs. For example, if a RUC has a T/O authorization of eight MOSs it is chronically short in six of them. Appendix C contains national and regional histograms of RUC MOS fill rates in the SMCR. Due to its length, a report detailing the fill rate for each MOS in each RUC over the last for years is omitted here but will be forwarded to HQMC, M&RA for Reserve Affairs. Figure 1 depicts the fill rate for all MOSs across all RUCs.

The majority of MOSs in the SMCR fall well below the 50 percent fill rate. The analysis sees some variation from region to region that is apparent in Appendix C. Table 2 depicts fill rates for a small sample of the RUCs contained in Appendix D. The analysis discovers shortages in every MOS throughout all of the regions. Table 3 depicts four MOSs, the number of RUCs that rate the MOS, the MOS average fill rate over those RUCs, and the fill rate standard deviation. These results are typical of most MOSs and a detailed breakdown of the fill rate for those four MOSs by RUC and state are included as Appendix E.

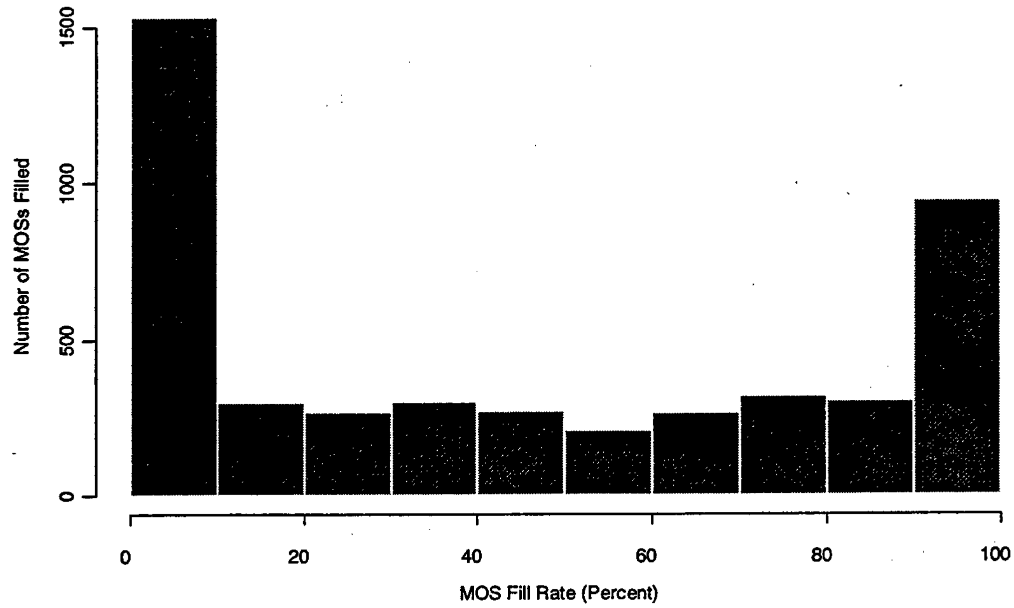


Figure 1. USMCR Actual MOS Fill Rate

Table 2. Sample RUC Strength Results

RUC	# Authorized	# Fill	% Fill	Region
00409	26	8	30.77	4
00527	38	5	13.16	3
14174	8	3	37.5	2
14201	37	8	21.62	1
14334	17	8	47.06	3
14641	37	7	18.92	4
21404	24	7	29.17	1
22325	17	4	23.53	2
74489	16	6	37.5	3

Table 3. Sample MOS Fills

MOS	TITLE	# RUCs	Mean Fill	Std Dev
0151	Administrative clerk	181	70.93	31.63
0231	Intelligence clerk	62	31.28	33.99
0331	Rifleman	36	54.57	33.54
3051	Warehouse clerk	133	63.99	34.7

Figure 2 depicts the RUC fill rate for Region 1. Appendix C contains the histograms for the other regions. The fill rates for both RUC and MOS are not Normally distributed and each region is decidedly different from the others. The graphs in Appendix C depict the MOS chronic shortages throughout each region. Each region has an average MOS fill for its RUCs well below 50 percent. All four regions have similar mean fill rates and the standard deviations are surprisingly similar. In short, the overall state of MOS manning levels within the USMC SMCR is consistently low. Table 4 depicts the mean and standard deviation for each region.

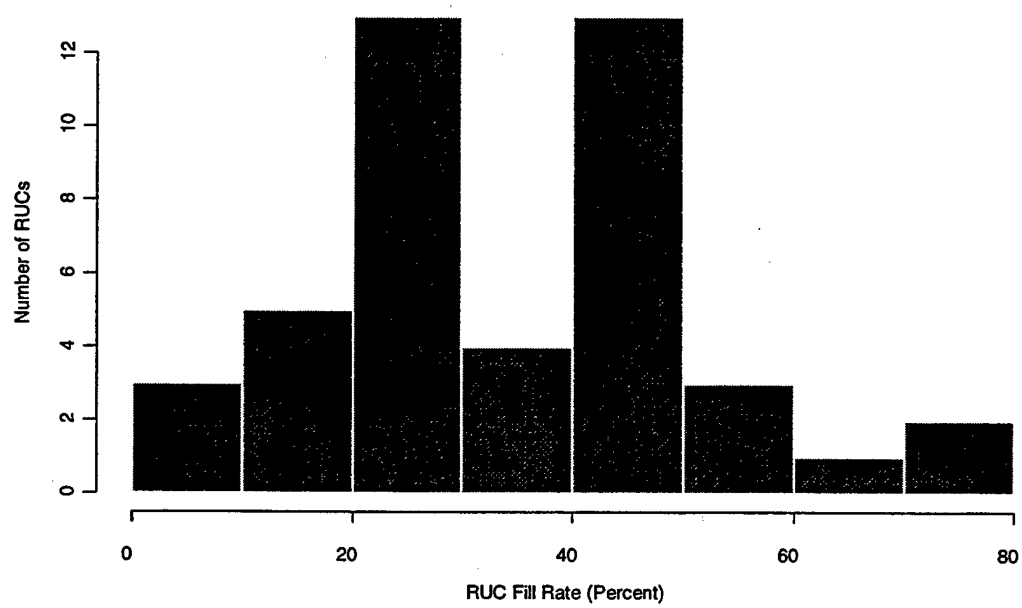


Figure 2. Region 1 USMCR Actual RUC Fill Rate

Table 4. Mean and Standard Deviation for Region MOS Fill Rates

	RUC Fill	
Region	**Mean**	**Std Dev**
1(Northeast)	35.31	17.70
2(North Central)	33.69	18.42
3(South)	36.6	19.7
4(West)	35.22	19.15

B. DEMOGRAPHIC INFLUENCE ANALYSIS

1. Goals and Data Source

The second part of the analysis determines if there are any demographic factors that account for the low MOS fill rates and if these factors are regional. The question of interest to M&RA for Reserve Affairs is if there is a particular demographic factor or group of factors that account for one region's MOS fill rate being different from another's. This section of the study uses demographic data from a number of government and private sources. The majority of the data came from the Bureau of Census, Federal Reserve Banks, DMDC, and the Department of Agriculture.

The analysis uses the RUC's MOS fill rate as the response variable and investigates several economic and population indicators. Economic factors include per capita income, disposable per capita income, earnings per job, total disposable income, local unemployment rate and household size. Population factors include local military population size, local population racial make-up, number of available 18 to 24 year old males, number of universities, and number of qualified military applicants (QMA) in the local area.

2. Results

a. Descriptive Analysis

The analysis sorts the 269 RUCs within the SMCR by state location and then groups the states into their respective regions. In the next step, the analysis calculates the MOS fill rate for each state. The fill rate for each state results from totaling the number of MOSs which each RUC within that state is authorized. The number of filled MOSs, that is MOSs above the chronically short determination level discussed previously, is calculated and then divided by the total number of authorized MOSs. This procedure produces the state's overall MOS fill rate; a total of 47 data points since four states have no RUCs at all. This technique prevents data from states with large numbers of RUCs from overpowering data from those states that contain few RUCs.

The study collects demographic factors at the state level since RUCs can recruit personnel up to 100 miles away and are generally located throughout the state. Appendix F contains the state percentage MOS fill rate and demographic factors the analysis uses. The analysis then plots the MOS fill rate against the demographic factors in a series of scatter plots in an attempt to identify significant demographic factors.

Appendix G contains the most interesting scatter plots. Figure 3 depicts a sample scatter plot for all 47 data points. The numbers within the scatter plot indicate the region the state with that MOS fill rate and number of 18 to 24 year old males belongs to. It appears that states with more 18 to 24 year old males fill fewer RUCs to adequate levels.

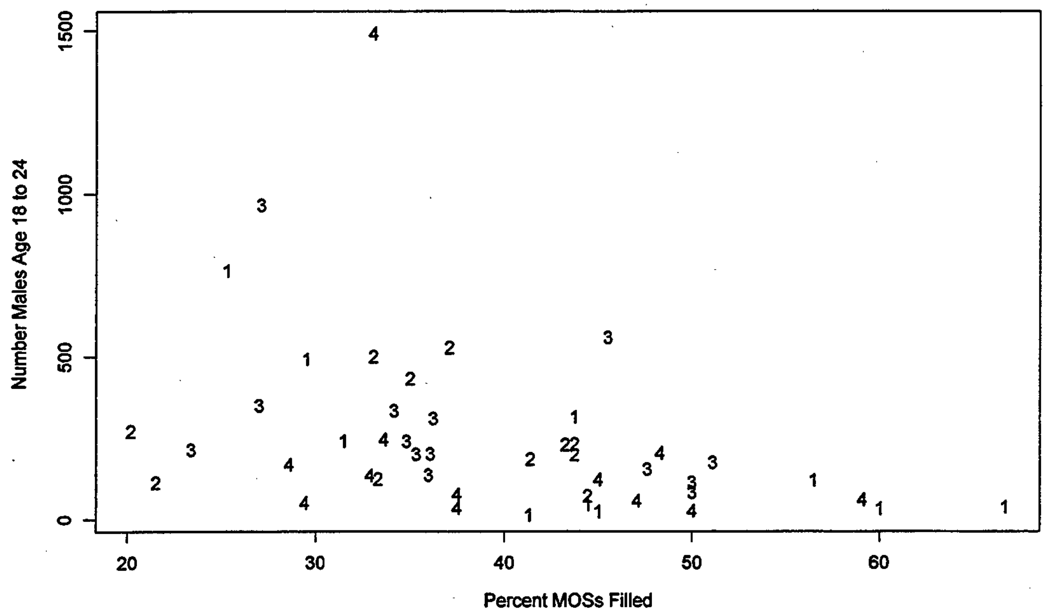


Figure 3. **Percent MOSs Filled for each State vs. Number Males Age 18 to 24 by Region**

The analysis then looks at each region individually to determine if this trend continues at the regional level. Figure 4 depicts a scatter plot for Region 1. In Region 1, the national trend seems to hold, and states with a lower population of 18 to 24 year old males have higher RUC MOS fill rates. Appendix G contains the scatter plots of demographic factors and state MOS fill rates.

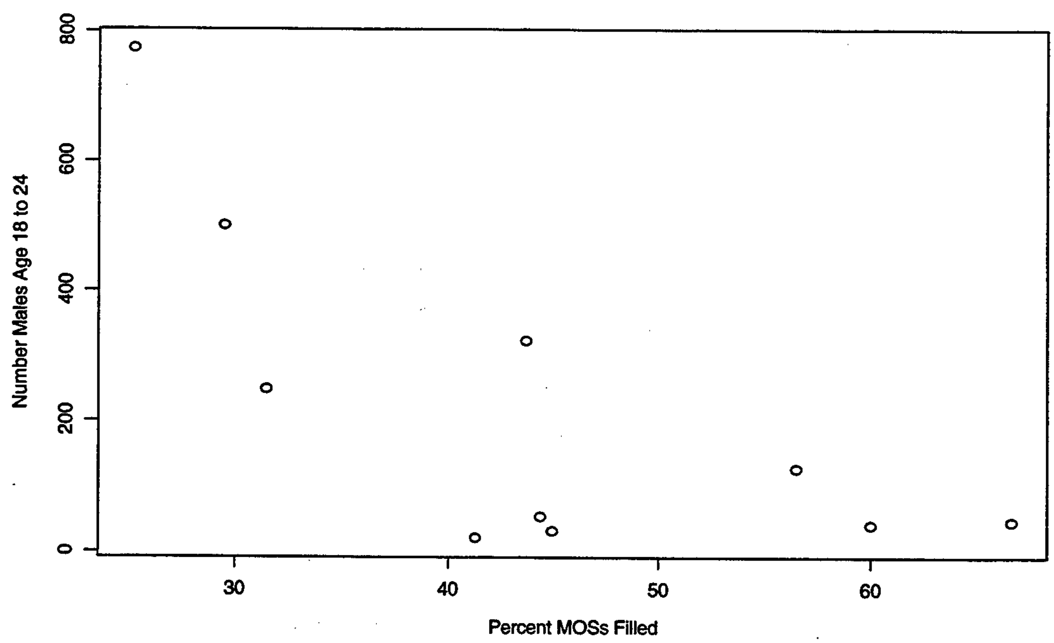


Figure 4. Region 1 Percent MOSs Filled vs. Number Males Age 18 to 24

At the national level, the analysis discovers this same negative trend in state MOS fill rates in a number of demographic factors. The demographic factors are number of 18 to 24 year old males, state population size, the total number of qualified military applicants (TQMA) within the state, number of White qualified military applicants (WQMA) within the state, number of universities within the state, and the number of state veterans.

Appendix G also contains the scatter plots for state MOS fill rates versus Youth Attitude Tracking Survey (YATS) results. DMDC maintains the YATS database that reports how likely high school youth will join the military. The reported percentages are for USMC reserve affiliation propensity. The database actually reports this figure for White males but the analysis derives the Black and Hispanic male propensity figures

through interpolation. The YATS database reports Black and Hispanic propensity to join at the national level and White male propensity to join at both the national and regional level. Assuming Black and Hispanic male propensity to join at the regional level follow the same trends as for White males, the analysis calculates the Black and Hispanic male propensity to join through appropriate ratios. The results indicate that high YATS scores do not translate into high MOS fill rates for the states.

The regional plots do not always coincide with the national demographic trends and usually only one or two regions are consistent with the national trends. Region 1 follows the national trend in the following demographic areas: number of 18 to 24 year old males, state population size, TQMA population, WQMA population, number of universities and veteran population size. Region 2 does not follow any of the national trends and displays a positive correlation only in the median income demographic factor. In Region 2, as the state's median income increases, the state MOS fill rate also increases.

Region 3 follows the national trend only in the state population size demographic factor. Region 3 shows a weak positive correlation between population size and MOS fill rate unlike Region 1's strong correlation. Additionally, Region 3 also displays a negative correlation with the median income demographic factor; as state median income increases state MOS fill rates decrease. Finally, Region 4 weakly correlates with the national trend in the following demographic factors: TQMA population, WQMA population, state population size, veteran population size, and number of universities within the state. As these demographic factors increase, Region 4's state MOS fill rates decrease slightly indicating a weak correlation between the two.

b. Regression Tree Analysis

The analysis determines the important demographic factors through data exploratory techniques in order to develop a regression tree to predict state MOS fill rates by demographic factors. The analysis models state MOS fill rate by the following demographic factors: 1) WQMA, 2) Black qualified military applicants (BQMA), 3) Hispanic qualified military applicants (HQMA), 4) percent Black population (PERBPOP), 5) percent Hispanic population, 6) percent White population, 7) White Youth Attitude Tracking Survey (WYATS), 8) Black Youth Attitude Tracking Survey (BYATS), 9) Hispanic Youth Attitude Tracking Survey (HYATS), 10) state unemployment rate, 11) number of universities, 12) size of the 18 to 24 year old male population, 13) state veteran population, and 14) earnings per job (EPJ). This analysis uses the regression tree to identify demographic factors pertinent to a particular region. If a majority of the states of a particular region end up in a leaf node as an explanation of that state's MOS fill rate, then that demographic factor is said to be influential in that region.

Figure 5 displays the regression tree. None of the regression tree's leaves consist of states from just one region. The leaf that comes closest is the leaf with a MOS fill rate of 57.46 percent. That leaf has four out of its five states from Region 1. The leaf with a 47.07 percent MOS fill rate consists of states west of the Mississippi River but has states from Regions 2, 3 and 4. Table 5 lists the leaf MOS fill rate, the demographic factors attributable to that leaf, and the states that reside in that leaf.

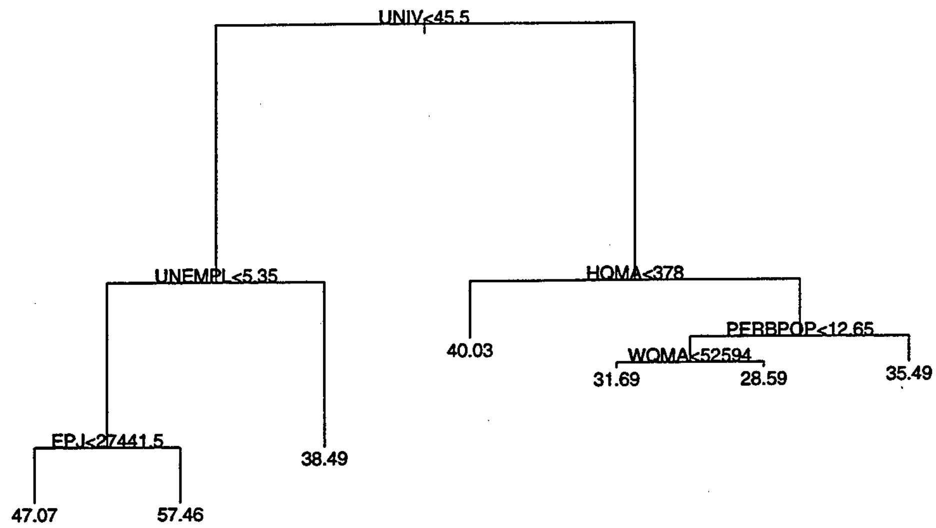


Figure 5. Regression Tree Model of MOS Fill Rates

Table 5. Regression Tree Leaves

Leaf MOS Fill Rate	Factors	States
38.49	UNIV<45.5;UNEMPL>5.35	AK,DC,HI,LA,ME,MT,NM, OR,WV
40.03	UNIV>45.5;HQMA<378	AL,IA,KY,MN,MO,MS,SC, TN
47.07	UNIV<45.5;UNEMPL<5.35;EPJ<27441.5	AR,AZ,ID,NE,OK,UT
57.46	UNIV<45.5;UNEMPL<5.35;EPJ>27441.5	CT,DE,NH,NV,RI
35.49	UNIV>45.5;HQMA>378;PERBPOP>12.65	FL,GA,IL,MD,MI,NC,NJ, NY,VA
31.69	UNIV>45.5;HQMA>378;PERBPOP<12.65; WQMA<52594	CO,KS,MA,WA,WI
28.59	UNIV>45.5;HQMA>378;PERBPOP<12.65; WQMA>52594	CA,IN,OH,PA,TX

C. RUC PERSONNEL ANALYSIS

1. Goals and Data Source

The third part of the analysis investigates the personal differences between RUCs in the Marines who man those RUCs. If the Marines of one RUC are significantly different from those of another RUC then understanding those differences might provide insight into targeting enlistment bonuses. After discussions with M&RA for Reserve Affairs, eight RUCs are chosen for further analysis (Weiss, personal conversation, December 1998). All of the RUCs are weapons companies located in eight different states. The states represented are CA, LA, OH, IL, MO, MA, NY and WV. Region 1 contains two of the RUCs (RUCs 14217 and 14227), Region 2 has three RUCs (RUCs 14167, 14176, and 14186), Region 3 contains two RUCs (RUCs 14137 and 14237) and Region 4 has one RUC (RUC 14127).

The database consists of 1,135 Marines and is a portion of the larger DMDC database. The analysis investigates several service- and individual-related factors. Service-related factors include Armed Forces Qualification Test categories (AFQTCAT) and percentile (AFQTPER), training category (TRNCAT), years of service (YOS), retirement points earned for the last year (RETPTS) and for the career (RETPTSC), satisfactory training years (SATYRS) and MGIB status (MGIBSTAT). Personal factors consist of marital status (MARITAL), current age (AGE), number of dependents (DEPNS) and racial background (RACETHN). Appendix A contains a detailed description of each factor.

The study uses graphical analysis and the Pearson's chi-squared test with the S-Plus "chisq.test" function for independence between the various RUCs and between

regions when practical. The null hypothesis for the test states that the RUCs' members are similar in personal attributes. A significant p-value allows rejection of the null hypothesis and leads to the conclusion that the RUCs are different in terms of personal demographics. The analysis consolidates some factors' levels in order to run the test. In order to keep the family-wise type I error less than .05, the significant p-value is set at .01 throughout the analysis since five tests are run on each data set.

2. Results

a. SATYRS Analysis

The variable SATYRS reports the number of satisfactory years the service member has spent in the USMC SMCR. Since the units under consideration are all similar, there should be no difference in the satisfactory years served by RUC personnel. For the analysis, the range for SATYRS is collapsed into years zero, one, two, three, four, five, six and seven or more years. The Pearson chi-square test returns an insignificant p-value (.0137) when the RUC data set is tested as a whole which fails to reject the null hypothesis indicating there are no differences between the RUCs in the area of satisfactory years served by the RUCs' members. The tests on Regions 1, 2 and 3 return insignificant p-values of .7084, .3913, and .0354 respectively.

The data is plotted using a Boxplot graph. Boxplots are convenient for displaying information about the center or median of the data indicated by the white line. The box in the graph is the spread or inter-quartile range of the data. Additionally, the plot depicts outliers by "whiskers" above and below the inter-quartile range. Boxplots are very useful in identifying symmetry within the data and between data sets (Hamilton, 1992). Figure 6 is the Boxplot for SATYRS.

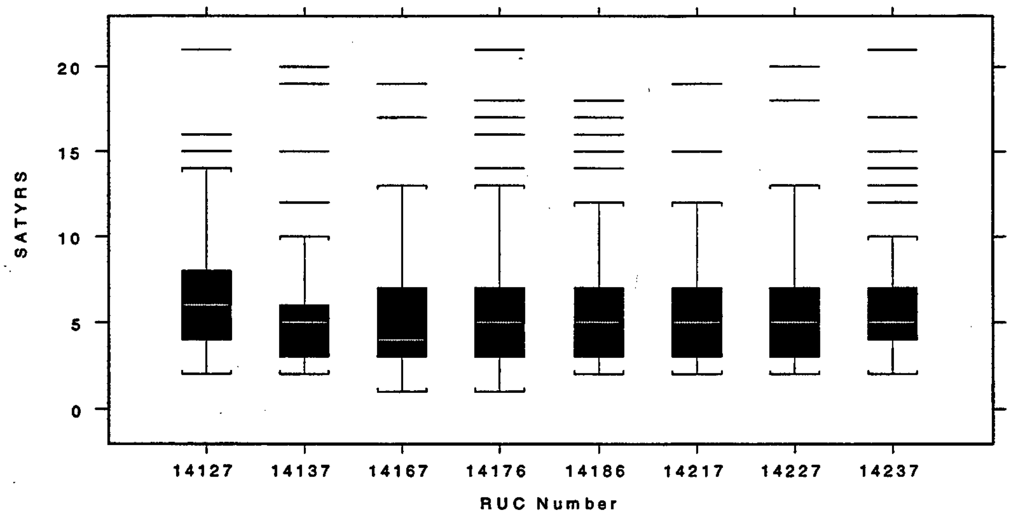


Figure 6. SATYRS Boxplot

b. AFQTPER Analysis

The variable AFQTPER reports the individual's actual percentage score on the AFQT upon his initial enlistment. Figure 7 is a Boxplot showing AFQTPER by RUC. Additionally, Figure 7 shows a good degree of variation between the RUCs. The analysis collapses AFQT scores into five bins of equal size. The ranges are 20-36 percent, 37-52 percent, 53-67 percent, 68-83 percent and 84-100 percent.

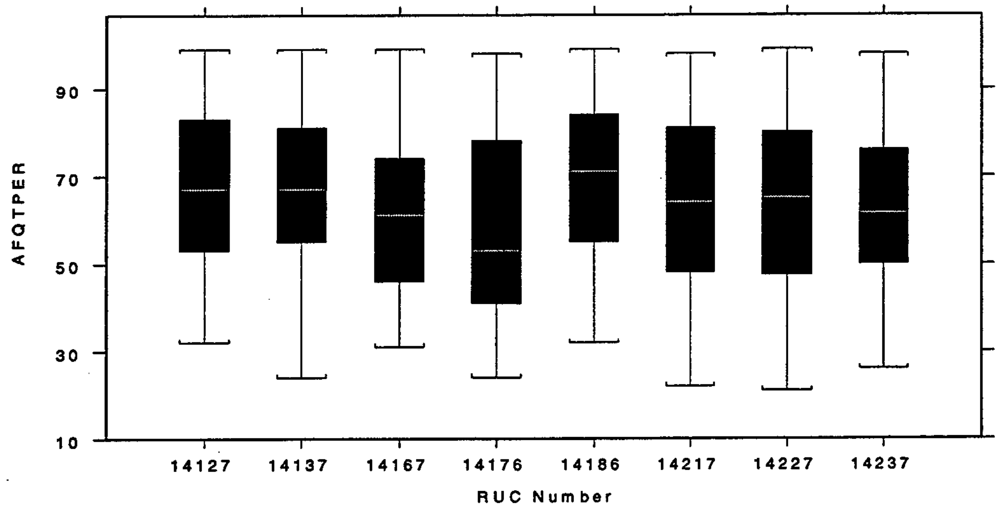


Figure 7. AFQTPER Boxplot

Applying a chi-square test to the data produces a significant p-value (.0001) and rejection of the null hypothesis for the whole group. The analysis uses the same ranges for AFQTPER regional analysis. Applying the chi-square test to Region 1 results in an insignificant p-value (.8792) and failure to reject the null hypothesis. Region 2's chi-square reports a significant p-value (.0002) and rejection of the null hypothesis. Region 3's chi-square test reports an insignificant p-value (.4822) and a failure to reject the null hypothesis. Finally, the analysis performs a chi-square test on the combination of Regions 1, 3 and 4. The test results in an insignificant p-value (.1361) thereby failing to a reject the null hypothesis indicating homogeneous populations in those regions for the AFQTPER variable.

c. AFQTCAT Analysis

The variable AFQTCAT reports the individual's AFQT category that the AFQT score fell into. The DOD establishes the AFQT categories as follows: 1) I (93-99

percentile), 2) II (65-92 percentile), 3) IIIA (50-64 percentile), 4) IIIB (31-49 percentile), 5) IV(A)-IV(C) (10-30 percentile) and 6) V (01-09 percentile). The military recruits in mental categories IIIA to I since those scoring lower do not generally possess the academic ability to perform required training.

The plots indicate differences in the proportion of Marines within each AFQT category between each region and each RUC. Of particular interest is RUC 14176 that shows the highest category of personnel in category IIIB in contrast to the rest of the RUCs. The RUC is located near Chicago, IL and may have a more difficult time recruiting Marines in category I and II. Applying Pearson's chi-square test to the data of RUCs as a group results in a significant p-value (0.0000) and a rejection of the null hypothesis for the entire group. The analysis then applies Pearson's chi-square test to each regional grouping of RUCs where applicable. Region 1 results in an insignificant p-value (.8541) and a failure to reject the null hypothesis. Region 2's Pearson's chi-square test reports a significant p-value (.0002) and a rejection of the null hypothesis. Region 3's test reports an insignificant p-value (.1221) and a failure to reject the null hypothesis.

The analysis then groups the regions that fail to show significance on the regional test and tests these RUCs for possible differences. The test on Regions 1, 3, and 4 reports an insignificant p-value (.2600) and fails to reject the null hypothesis. Figures 8 and 9 graphically display AFQTCAT by region and by RUC.

d. AGE Analysis

The variable AGE reports the Marine's age of the population comprising the RUC. The AGE variable is also reduced to two groups. The first group consists of

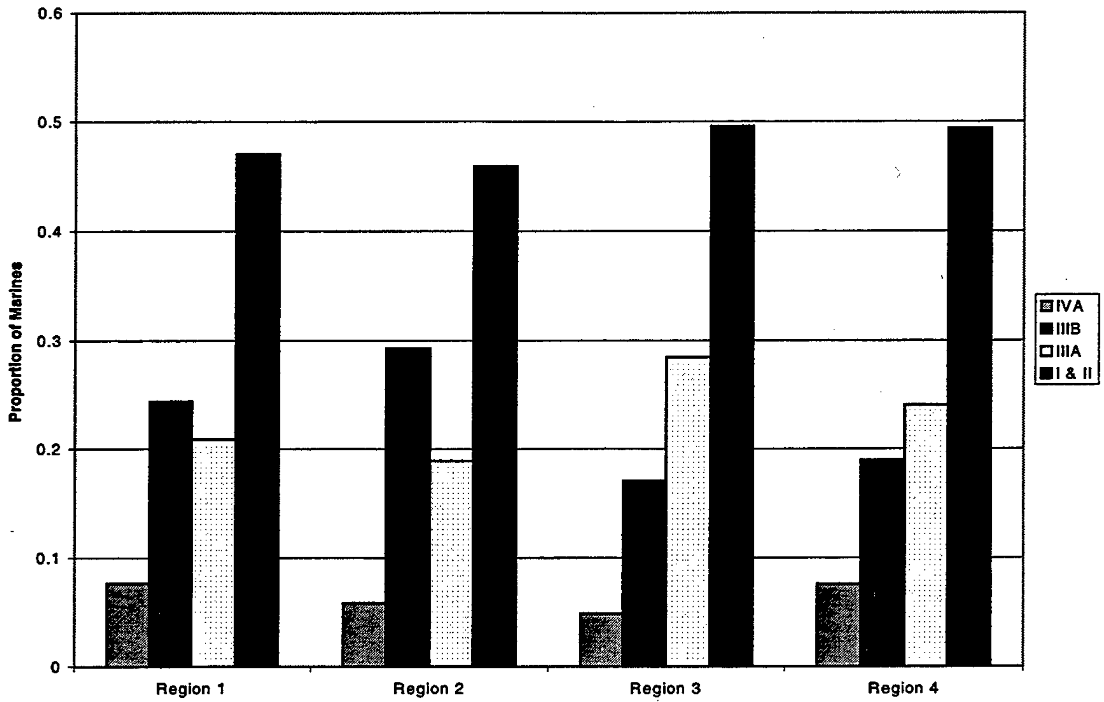


Figure 8. Regional AFQTCAT

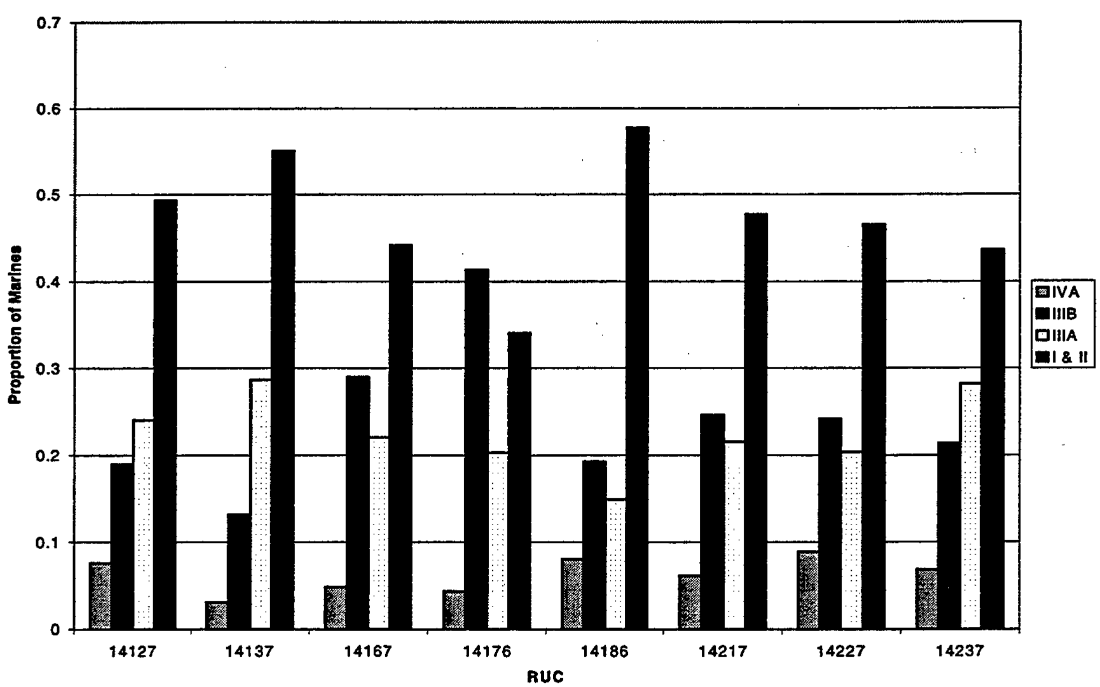


Figure 9. RUC AFQTCAT

individuals up to age 24 and the second group comprises individuals 24 years old and older. A Pearson's chi-square test is run on the entire RUC data set and results in a significant p-value (0.0000) and a rejection of the null hypothesis.

The same age groupings are carried into the regional analysis with Region 1's Pearson chi-square test reports an insignificant p-value (.1510) and a failure to reject the null hypothesis. The Pearson chi-square test for Region 2 reports a significant p-value (.0059) thereby allowing rejection of the null hypothesis. Region 3's Pearson's chi-square test also reports a significant p-value (.0098) permitting rejection of the null hypothesis.

A chi-square test on the combined data set of Regions 1 and 4 results in an insignificant p-value (.2103) and a failure to reject the null hypothesis. Table 6 reports the mean and standard deviation for AGE for each region and RUC. Additionally, Figure 10 is a Boxplot for the RUCs' AGE data.

Table 6. Mean and Standard Deviation of AGE

REGION	**Mean**	**Std Dev**
1	24.21	4.34
2	23.89	4.54
3	22.97	4.00
4	24.53	4.1
RUC	**Mean**	**Std Dev**
14127	24.53	4.1
14137	22.22	3.562
14167	24.23	4.865
14176	24.38	4.402
14186	23.15	4.28
14217	23.71	3.964
14227	24.63	4.598
14237	23.79	4.308

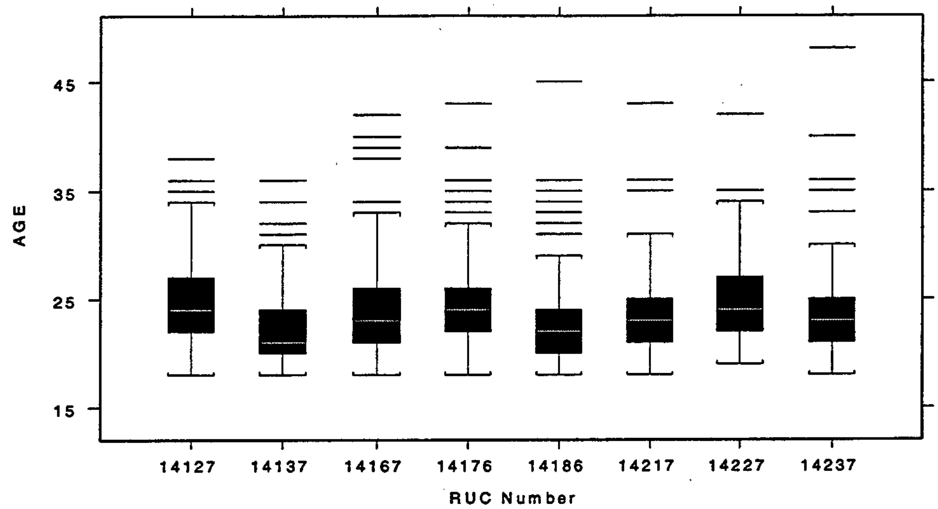


Figure 10. AGE Boxplot

e. *DEPNS Analysis*

The DEPNS variable reports the number of dependents each service member supports. The data is divided into three groups: single, married with one dependent, and married with two or more dependents. A Pearson's chi-square test run on the entire RUC data set reports a significant p-value (.0073) and rejection of the null hypothesis. The Pearson's chi-square test of Regions 1, 2, and 3 result in insignificant p-values of .4383, .3452, and .2048 respectively. These regional results all fail to reject the null hypothesis. Figures 11 and 12 display the DEPNS data groupings by region and RUC.

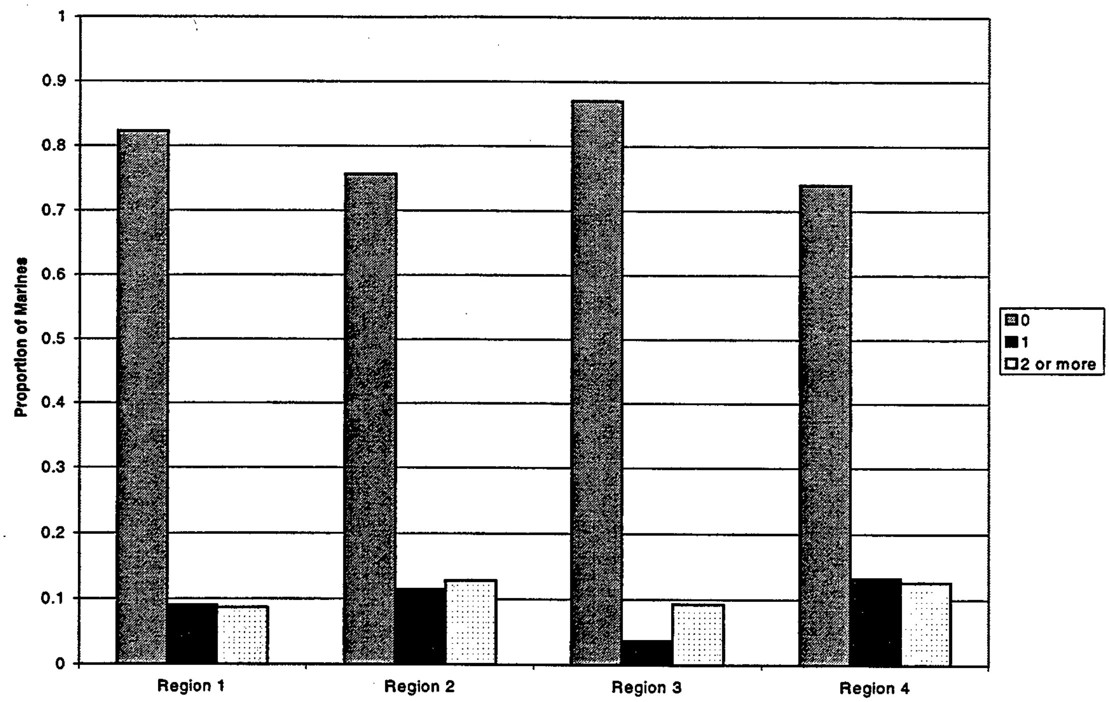


Figure 11. Regional DEPNS

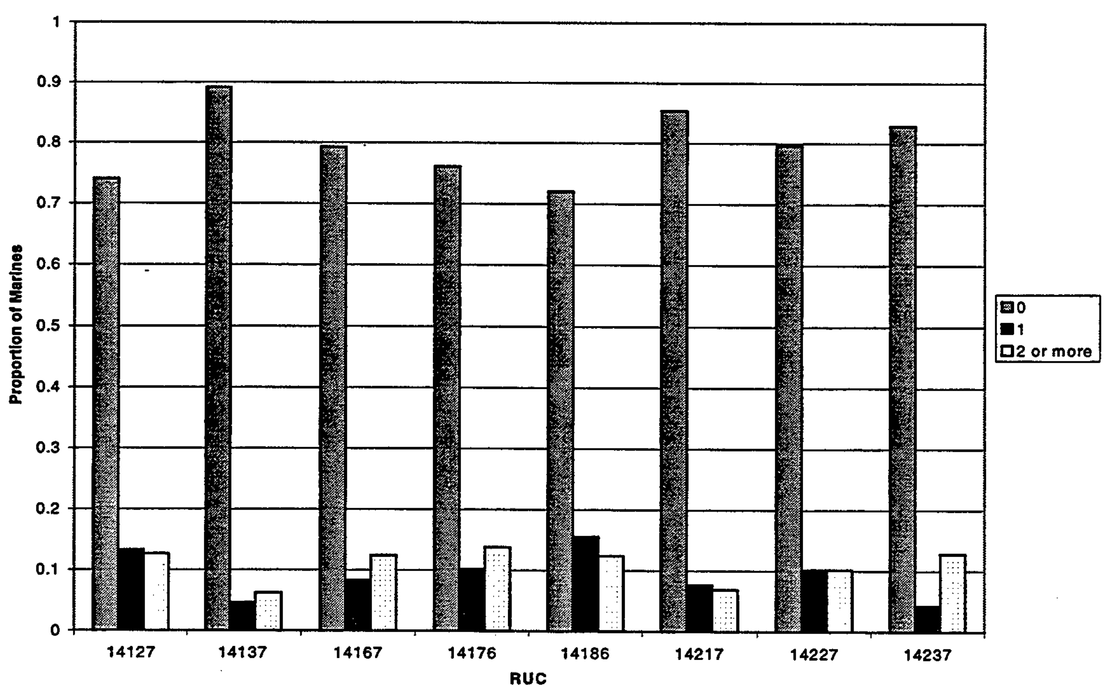


Figure 12. RUC DEPNS

f. *MARITAL Analysis*

The MARITAL categorical variable consists of the two categories "single" and "married." A Pearson's chi-square test run on the entire RUC data set reports a significant p-value (.0024) and allows rejection of the null hypothesis. The same Pearson's chi-square test is applied to Regions 1, 2, and 3 individually and results in insignificant p-values of .5139, .0719, and .4371 respectively. These regional results therefore fail to reject the null hypothesis in each case. Figures 13 and 14 depict the MARITAL variable by region and by RUC.

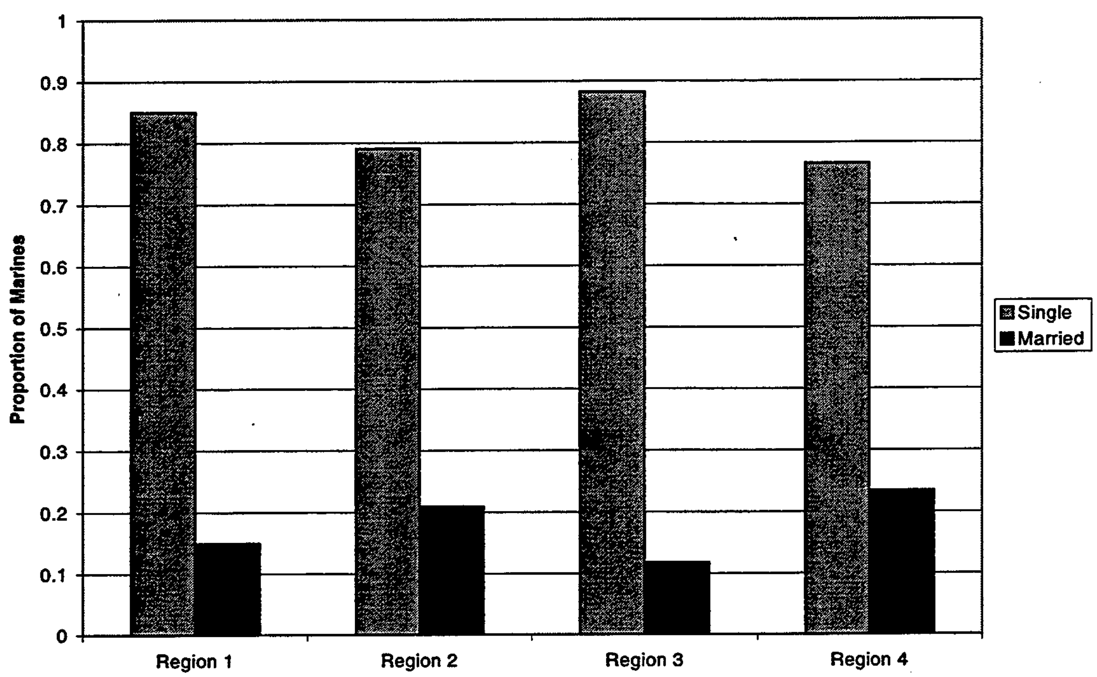


Figure 13. Regional MARITAL

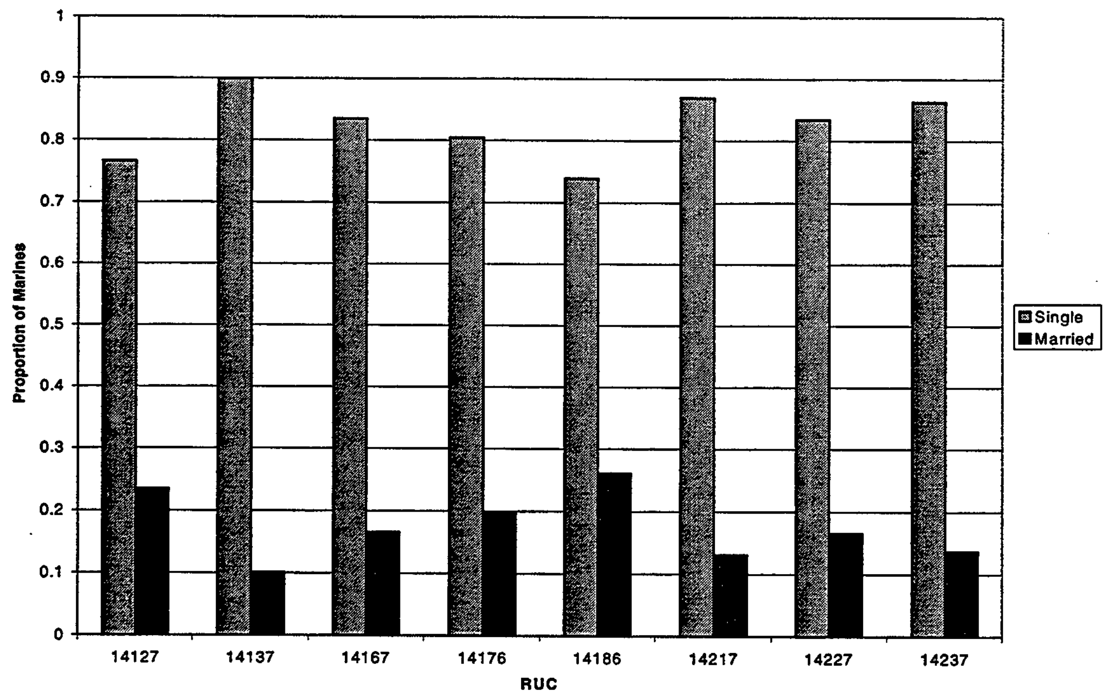


Figure 14. RUC MARITAL

g. RETPTS and RETPTSC Analysis

The variables RETPTS and RETPTSC report the retirement points the drilling reservist received during the last fiscal year and has accumulated during his total reserve service respectively. A large number of retirement points during the last fiscal year indicate strong reserve affiliation. Additionally, a large number of career retirement points indicate the individual has served in the SMCR for a number of years. Variation appears in both variables at the regional and RUC level.

The data for RETPTS is consolidated into the following groupings: 0-58, 59-120, 121-182, and 183-245 points. A Pearson's chi-square test run on the entire RUC RETPTS data set reports a significant p-value (.0001) allows rejection of the null hypothesis. Region 1's Pearson's chi-square test reports an insignificant p-value (.2378) and fails to reject the null hypothesis. However, both Region 2's and Region 3's

Pearson's chi-square test report significant p-values of .0048 and .0025 respectively and rejection of the null hypothesis. Finally, a chi-square test reports an insignificant p-value (.0740) for the combined Regions 1 and 4 and leads to a failure to reject the null hypothesis.

A Pearson's chi-square test run on the complete RUC RETPTSC data set reports an insignificant p-value (.0135), not allowing rejection of the null hypothesis. Region 1's and Region 2's Pearson chi-square test report insignificant p-values of .0992 and .4774 respectively and fails to reject the null hypothesis. Region 3's test also reports an insignificant p-value of .0455. Table 7 summarizes the mean and standard deviations for RETPTS and RETPTSC for both regions and individual RUCs. Figures 15 and 16 depict the Boxplots for both RETPTS and RETPTSC.

Table 7. Mean and Standard Deviation of RETPTS and RETPTSC

Region	Mean RETPTS	Std Dev RETPTS	Mean RETPTSC	Std Dev RETPTSC
1	86.9	60.11	520.9	553
2	90.86	57.43	594.8	654
3	90.13	61.25	500	550.2
4	94.71	79.93	727	800.1
RUC	**Mean RETPTS**	**Std Dev RETPTS**	**Mean RETPTSC**	**Std Dev RETPTSC**
14127	94.71	79.93	727	800.1
14137	97.77	58.88	413.2	315.5
14167	81.88	51.85	554.7	593.4
14176	83.12	55.55	585.7	603.3
14186	105.6	61.05	638.7	743
14217	88.47	62.00	471.1	476.2
14227	84.31	58.84	562.1	607.8
14237	81.71	62.95	595.7	715.5

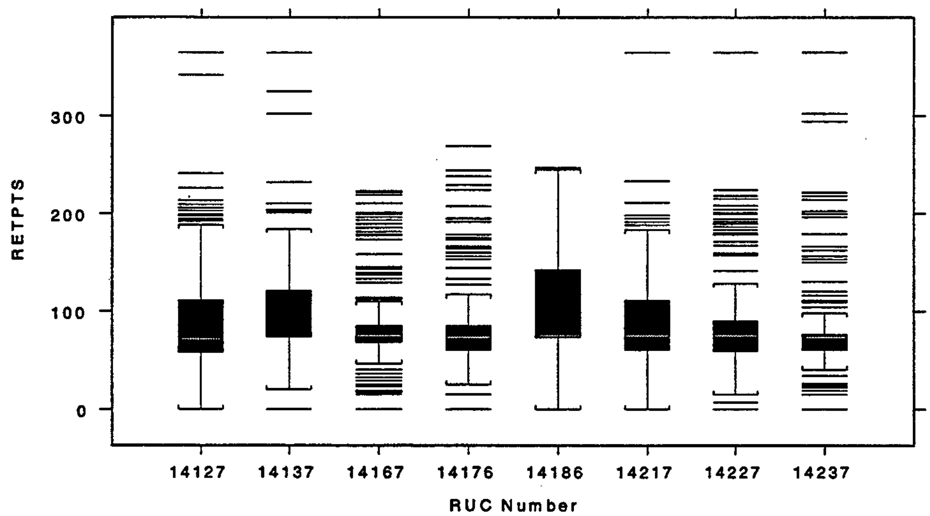


Figure 15. RETPTS Boxplot

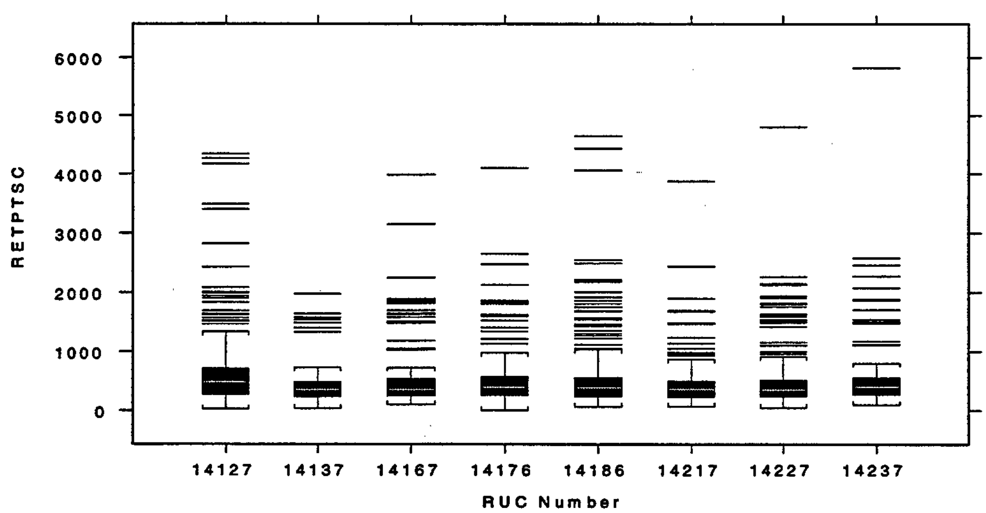


Figure 16. RETPTSC Boxplot

h. YOS Analysis

The YOS variable is generated by subtracting the service member's pay entry base date from the current date. It provides an indication of total military service

time to include active duty or prior reserve service time. The raw data is divided into three cells: 0-3.68 years, 3.68-7.59 years, and more than 7.59 years.

A Pearson's chi-square test run on the complete data set results in a significant p-value (.0010) and a rejection of the null hypothesis. Region 1's and Region 2's chi-square test results in insignificant p-values of .1277 and .3088 respectively and fails to reject the null hypothesis. However, Region 3's chi-square test does result in a significant p-value (.0063) thereby rejecting the null hypothesis.

The analysis groups the regions that report an insignificant p-value on the previous tests. The group of Regions 1, 2, and 4 report an insignificant p-value (.0162) for the chi-square test statistic. The mean and standard deviation are calculated for each region and RUC and are included in Table 8. Figure 17 depicts a Boxplot of the data.

Table 8. YOS Mean and Standard Deviation

Region	**Mean**	**Std Dev**
1	3.66	3.45
2	3.77	3.78
3	3.49	3.33
4	4.34	3.7
RUC	**Mean**	**Std Dev**
14127	4.34	3.7
14137	3.05	3.1
14167	3.65	3.77
14176	4.04	3.84
14186	3.66	3.73
14217	3.46	3.23
14227	3.82	3.62
14237	3.97	3.52

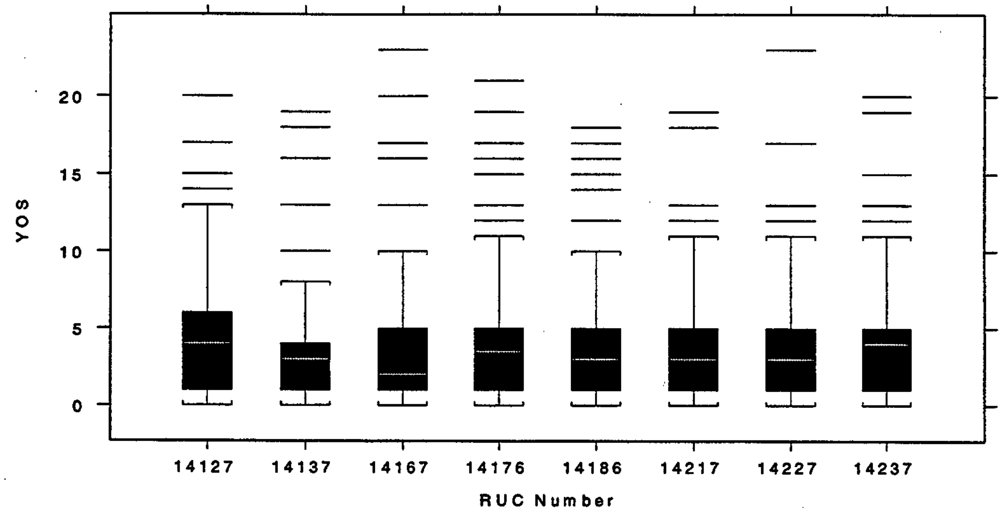


Figure 17. YOS Boxplot

i. TRNCAT Analysis

The variable TRNCAT is a snap shot of the service member's current status within the unit. The variable takes on one of two values indicating the individual is either fully qualified in his MOS or is awaiting training. A Pearson's chi-square test is performed on the entire data set resulting in an insignificant p-value (.0137) and fails to reject the null hypothesis.

The same test is then run on each regional data set. Region 1's chi-square test produces an insignificant p-value (.0265) and fails to reject the null hypothesis. The chi-square tests for Region 2 and Region 3 also result in insignificant p-values of .0925 and .9762 thereby failing to reject the null hypothesis. Figures 18 and 19 depict the regional and RUC TRNCAT data results.

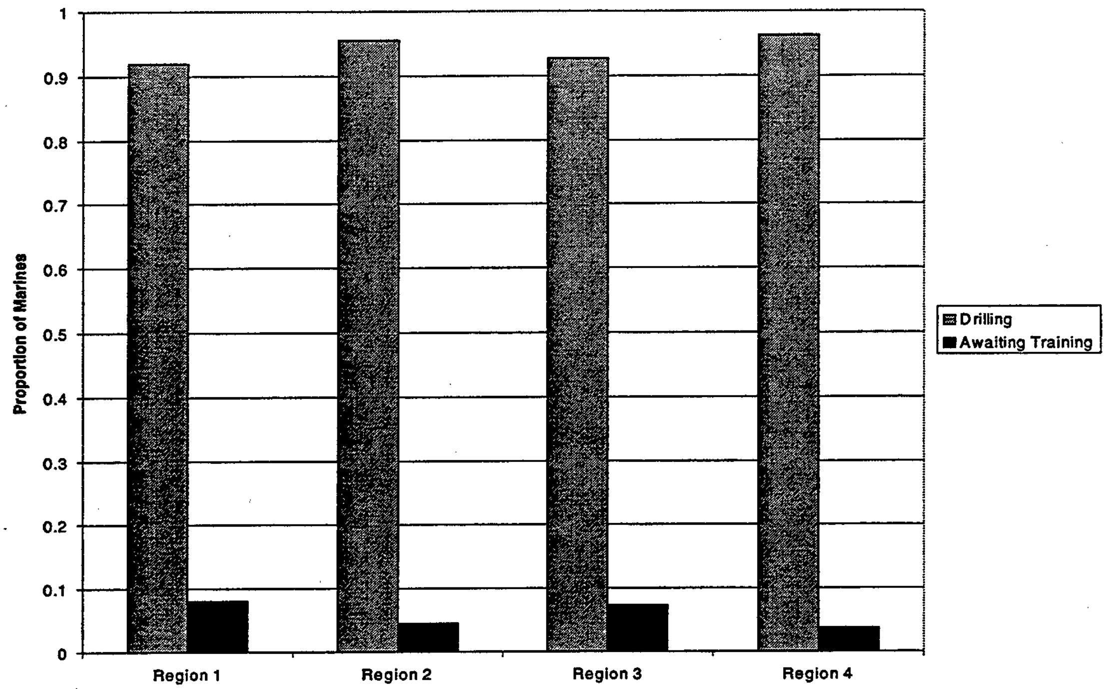


Figure 18. Regional TRNCAT

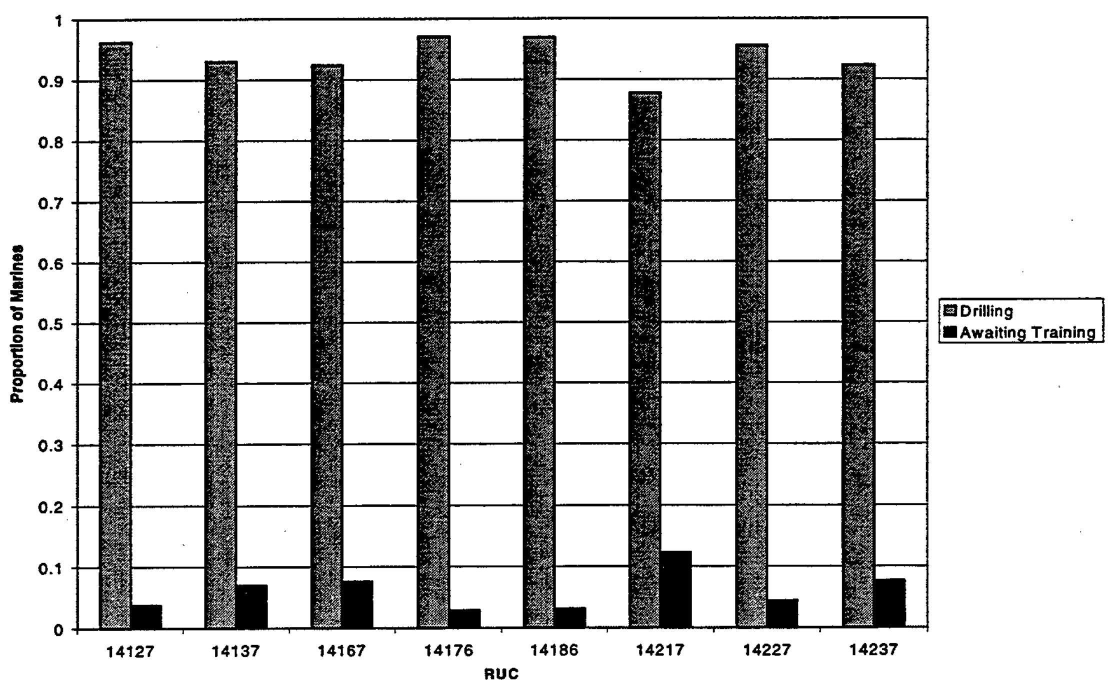


Figure 19. RUC TRNCAT

j. RACETHN Analysis

The RACETHN variable provides a look at the racial makeup at the regional and RUC levels. While the data fields in the original database include several ethnic backgrounds, the analysis considers only two values, White and non-White. The plots indicate large variations in racial makeup of units at both the regional and unit levels. The analysis conducts a Pearson's chi-square test on the entire data set and reports a significant p-value (0.0000), thereby rejecting the null hypothesis. The chi-square test also finds significant p-values for each region. Regions 1 and 2 have p-values of 0.0000 permitting rejection of the null hypothesis while Region 3 has a p-value of .0300 not permitting rejection of the null hypothesis. The chi-square test on Regions 3 and 4 results in a significant p-value (0.0000) permitting rejection of the null hypothesis. Figures 20 and 21 depict the regional and RUC RACETHN data values.

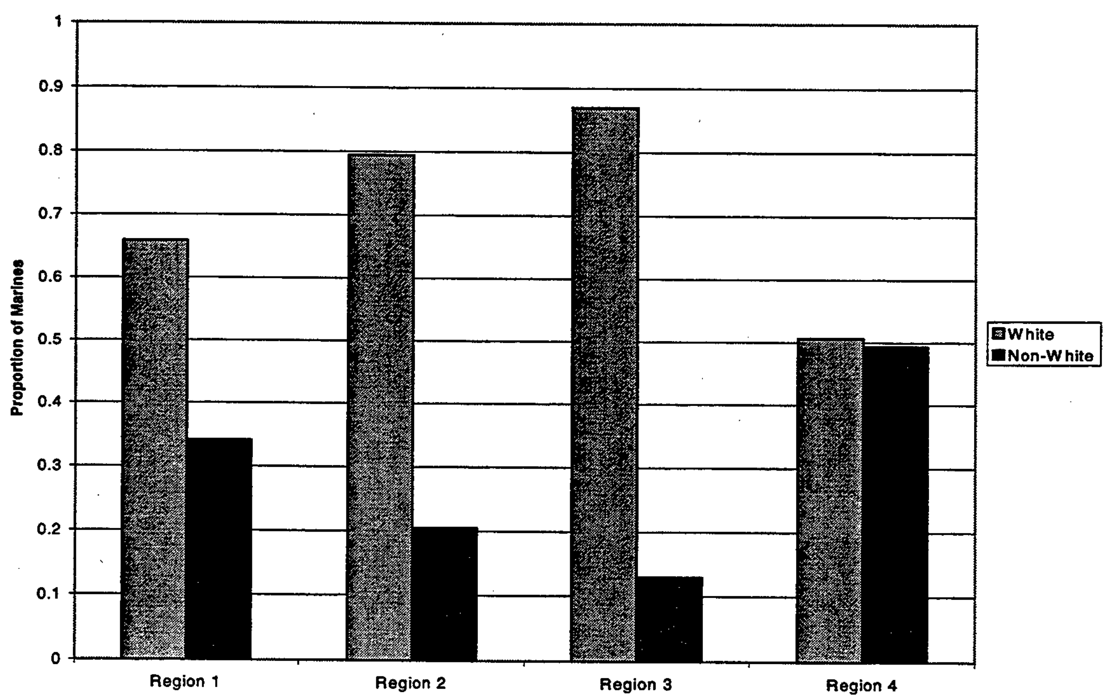


Figure 20. Regional RACETHN

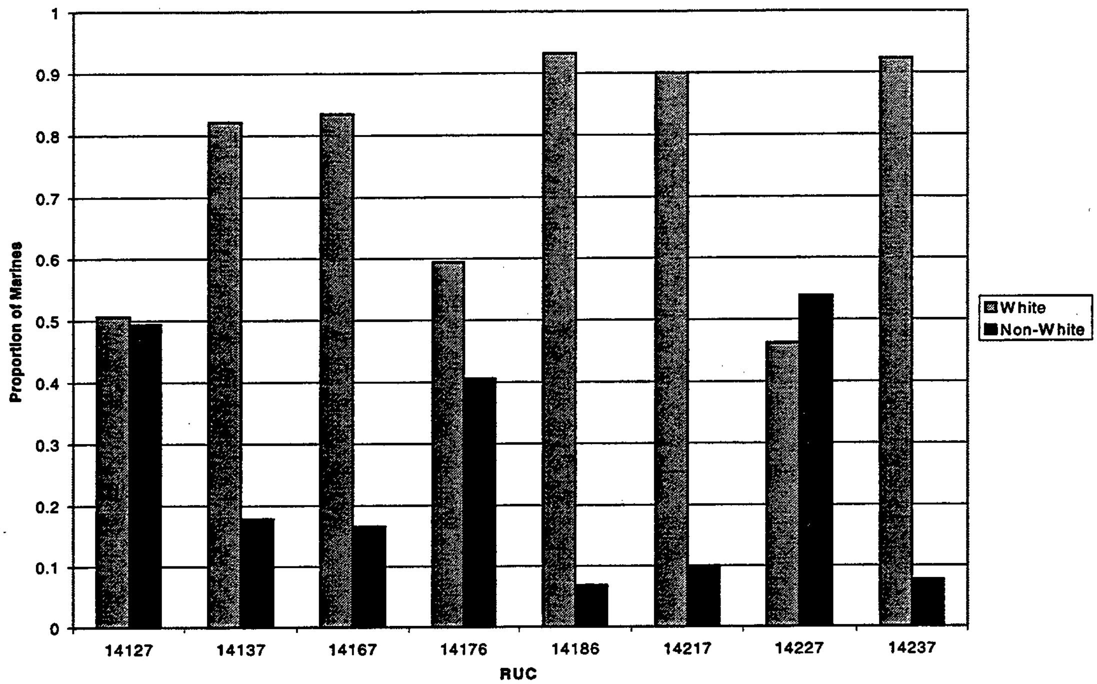


Figure 21. RUC RACETHN

k. MGIBSTAT Analysis

The MGIBSTAT variable reports the individual's current enrollment status in the MGIB. While the data reports several fields, the analysis collapses the variable into two values. The value indicates that either the reservist is qualified for the benefit or is denied the benefit.

The Pearson's chi-square test reports a significant p-value (.0026) resulting in rejection of the null hypothesis. The chi-square test is then applied to each regional database. The chi-square tests for Regions 1 and 2 both fail to provide significant p-values. Region 1 has a p-value of .1076 while Region 2 has a p-value of .1016. In both cases, the test fails to reject the null hypothesis. Finally, Region 3's chi-square test does return a significant p-value (.0002) thereby allowing rejection of the null

hypothesis. Finally, the chi-square test on the data set comprising regions 1, 2 and 4 produces an insignificant test statistic of .0664 and fails to reject the null hypothesis. Figures 22 and 23 depict the MGIBSTAT data at both the region and RUC levels.

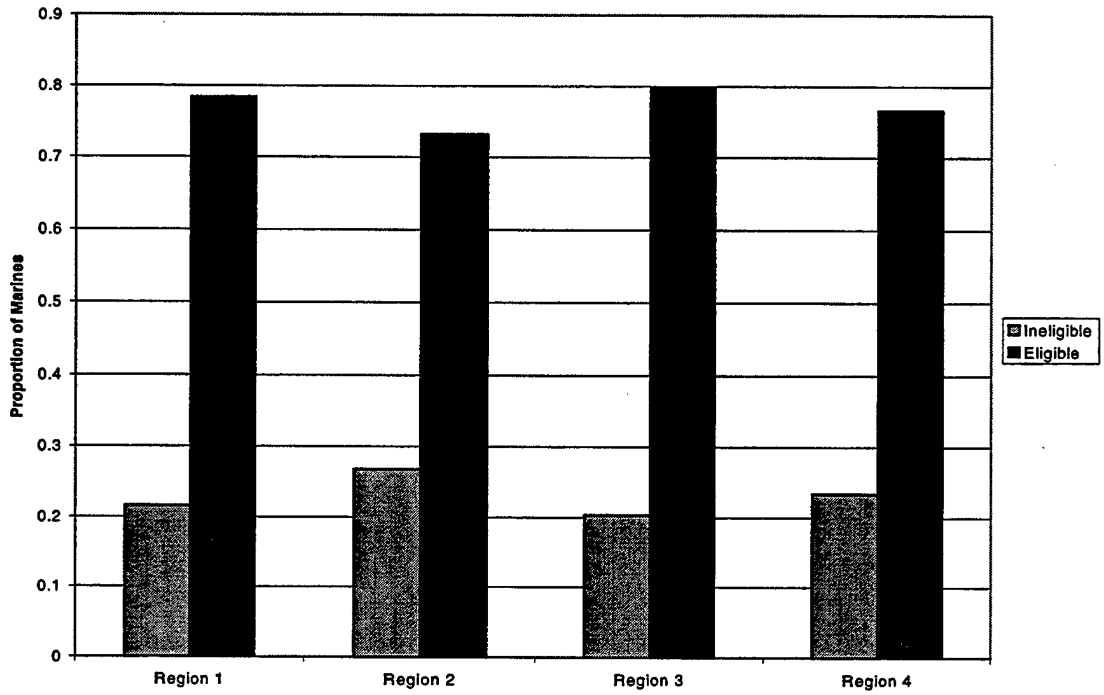


Figure 22. Regional MGIBSTAT

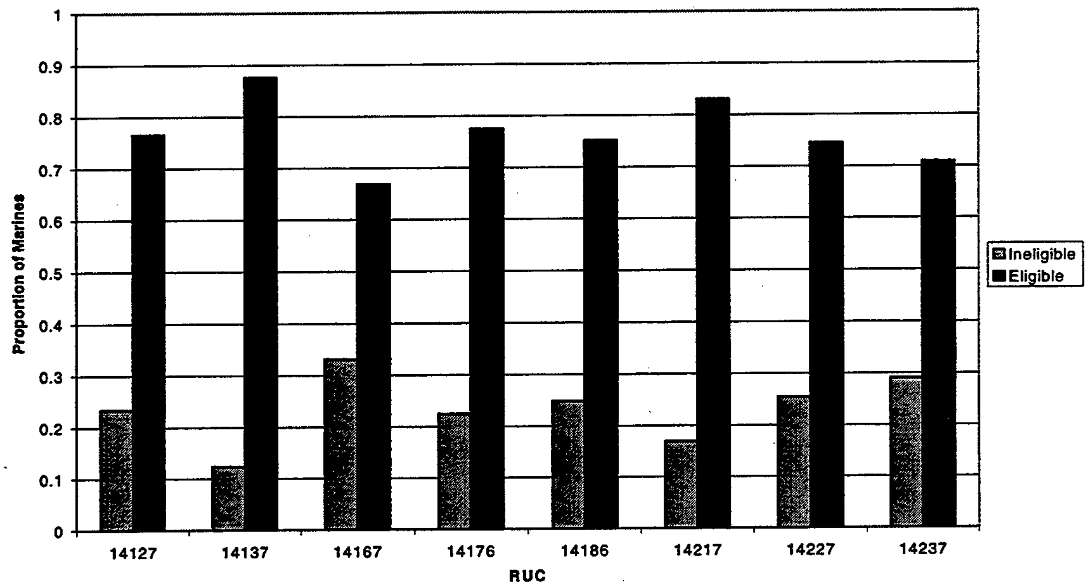


Figure 23. RUC MGIBSTAT

D. SUMMARY

The study's analysis begins with identifying chronically short MOSs within the USMC SMCR establishment. The analysis finds shortages in all MOSs in every RUC across all regions. The shortages are not confined to any particular MOS or family of MOSs, and the same MOS chronically short in several geographical locations. Appendix D summarizes the results of this part of the analysis.

The second part of the analysis identifies demographic factors that account for the MOS fill rates throughout the country. Of particular interest are factors that may account for fill rates within a region thereby identifying regional demographic factors. The analysis looks at several demographic factors but fails to identify any factor that might account for regional fill rates. By grouping RUCs by state and analyzing those same

variables, differences appear and produce a regression tree that identifies factors accounting for the state MOS fill rates. The variables EPJ, UNIV, UNEMP, HQMA, WQMA and PERBPOP are the most significant variables in accounting for state MOS fill rate differences.

Finally, the analysis determines if personnel assigned to a RUC have personal attributes or characteristics different from other personnel in other RUCs. Using the DMDC RCCPDS data, a number of personal factors are investigated through graphical analysis and the Pearson's chi-square test. The analysis chooses a group of RUCs, weapons companies, which possess roughly the same MOS makeup, number of personnel, operational T/O and mission. The RUCs are spread throughout the United States and represented all four regions in varying degrees. The analysis finds regional and unit differences in several of the analyzed personal variables. The significant finding is that the RUC population characteristics are not consistent nationally or regionally even among similar units. Additionally, some of these differences appear to be regional in nature while others tend to remain at the unit or RUC level.

V. DISCUSSION

A. CHRONICALLY SHORT MILITARY OCCUPATIONAL SPECIALTIES ANALYSIS

The analysis of MOSs identifies chronically short Military Occupational Specialties (MOSs) in every Reporting Unit Code (RUC) within the US Marine Corps (USMC) Selective Marine Corps Reserve (SMCR). These shortages are not confined to any particular MOS or any region. However, MOSs usually filled by senior enlisted personnel tend to fill at a much higher rate regardless of MOS. It is the entry or junior rank MOSs that seem to suffer the greatest shortfalls. Additionally, certain technical MOSs have lower fill rates than the less technical MOSs.

The USMC SMCR attempts to alleviate some of these MOS fill rate problems by establishing detachments in communities that have the greatest probability of filling those MOSs (Weiss, personal conversation, December 1998). For example, a parent RUC in Indiana whose mission is small electronic equipment repair might have a small detachment in San Jose, California to try and tap into the local community's expertise. Where this occurs, MOSs fill at a higher rate, but it is hypothesized that unit cohesion and proficiency likely decline because of the geographic separation.

Another MOS fill rate trend is the tendency for units to fill Table of Organization (T/O) MOS requirements with personnel with similar MOSs. The RUC's T/O might authorize the unit only administration clerks with an MOS of 0151, yet the unit reports on the monthly Reserve Common Component Personal Data System (RCCPDS) Marines with the MOS of 0121 or 0131. The latter MOSs belong to the general 01XX administrative family of MOSs, and it appears the unit is filling the required 0151 billet

with a close substitute. However, the RCCPDS report does not indicate the Marine is awaiting training. This trend occurs in the data throughout the four-year observation period.

The unit can schedule a Marine filling a billet not in their MOS for the appropriate school and then assign him the MOS upon school completion. However, there is no way to determine if these Marines are scheduled to receive the necessary schooling in order to acquire the billet MOS. The study observes this trend to fill required billet MOSs with Marines possessing a close substitute MOS in several MOS families throughout the analysis.

Another trend in the chronic MOS analysis is the large number of disassociated MOSs in a particular unit. For example, one RUC, an infantry company, reports a Marine on hand with the MOS of 7212, stinger gunner; however the unit's T/O does not authorize a Marine with this aviation-ground MOS. The Marine is filling a billet and probably obtaining on-the-job training for that billet; he most likely is not receiving training in his primary MOS.

Because of the current highly politicized nature of SMCR RUC placement, the identified MOS shortages will continue to exist. The SMCR attempts to resolve this problem with the satellite detachment policy, apparently with little success. The best alternative is to pursue a "grow your own" policy and recruit personnel for target MOSs from the RUC's local community. Coupled with the satellite detachment policy when required, the potential exists for significant reductions in the number of chronically short MOSs within the USMC SMCR.

B. DEMOGRAPHIC INFLUENCE ANALYSIS

1. Graphical Analysis Observations

This portion of the analysis investigates the relationship between MOS fill rates and several demographic factors. The study collapses the individual RUC MOS fill rates into 47 state MOS fill rates to include the District of Columbia. RUC density is much larger in some states than in others and this technique seeks to place every state at an equal level. The question the study seeks to answer is if demographic factors play any role in MOS fill rates at the regional level.

Graphic interpretation indicates national trends in male--ages 18 to 24, population size, Qualified Military Applicants (QMA) and White QMA (WQMA) population size, veteran population size, number of universities within the state, and state median income. In all but two of the demographic factors, state median income and number of universities within the state, the relationship to state MOS fill rate is counter-intuitive. Where these values are larger, RUC MOS fill rates are smaller. However, these trends are strongly evident only in Region 1, only slightly evident in Region 4, and seemingly absent in Regions 2 and 3.

Region 1, the Northeast, is the most urban region in the country with numerous large population centers in the area. The large populations associate with low state MOS fill rates as a result of these population centers. Here youth have numerous opportunities for supplemental income jobs that do not require the contractual obligations that serving in the Reserve Forces require. Additionally, youth in large metropolitan areas are less likely to travel up to 100 miles for reserve duty when other local employment opportunities exist nearby.

Another factor at play may be the availability and reliability of public transportation and the lack of privately-owned transportation for potential reservists from these large metropolitan areas. Individuals in large cities do not view privately-owned vehicles as a necessity and many do not own them. The very nature of reserve duty almost precludes the use of public transportation since the reservist must bring his or her military equipment to drill, and the unit itself will not provide transportation to and from the unit for drilling reservists. The individual will not consider taking a job he can not easily get to. Therefore, these population indicators do not translate into higher state MOS fill rates in Region 1.

Regions 2 and 3 are more rural and display no trends concerning population density factors. This rural population factor may also account for the extremely weak correlation between Region 4 and the investigated population density demographic factors. Region 2 and to a lesser extent Region 3 do show correlation with household median income. States with higher median income have higher MOS fill rates in Region 2 while the opposite is true for Region 3.

Both Region 2's and Region 3's results support previous moonlighting theory findings. Region 2's correlation supports Amirault's (1995, 1996 & 1997) work. He finds higher-paying job workers more likely to moonlight. However, Region 3's results support Hammel's (1967) findings that as personal income increases the propensity to moonlight decreases. Amirault's and Hammel's work are at the national level, and the results indicate MOS fill rates are influenced to a much higher degree by regional and state characteristics. Different RUCs appear to behave according to different moonlighting economic models.

Finally, Region 1 shows a negative correlation with the density of higher education institutions. As the number of colleges increase within a state, the state MOS fill rate declines. A prospective applicant probably views the two alternatives as conflicting and chooses to do one or the other. Because of the contractual obligations of reserve duty, his perceptions about reserve duty obligations are to some degree correct. This factor does not influence state MOS fill rates in any other region.

2. Regression Tree Analysis

After failing to identify demographic factors to account for state MOS fill rates at the regional level for regions other then Region 1, the analysis looks at the state level to try and identify possible influential factors. The regression tree analysis produces an interesting set of demographic factors to account for state MOS fill rates.

The states with the highest MOS fill rates have fewer universities, lower unemployment rates and higher earnings per job rates. Reservists in these states, which come from Regions 1 and 4, view the decision to join the reserves as a supplemental income decision much as Amirault (1995, 1996 & 1997) predicts. The second largest MOS fill rate group, comprised of states from Regions 2, 3 and 4, mirrors the first with the exception that these states have lower earnings per job rates in support of Hammel's (1967) theory. While the two theories initially appear to conflict with each other, it appears local demographics play a much larger role than regional ones in accounting for the individual's decision to enlist in the SMCR.

The results of the regression tree also conflict with the work of Holzberger (1986). When considering the size of the Black population within a state, the analysis finds a split between states possessing a higher Black population maintaining higher state

MOS fill rates and states with a lower Black population percentage having lower MOS fill rates. This demographic factor overshadows the WQMA demographic factor that Holzberger finds to be a key predictor at the national level. In fact, states with higher WQMA populations have lower MOS fill rates. The attributes that make an individual desirable for enlistment into the SMCR also place him in the prime recruiting group for active duty enlistment, the civilian job market, or higher education.

The regression tree does support Holzberger's assertions on the importance of relatively high levels of income and general affluence since states with higher earnings per job have the highest MOS fill rates. Of interest however, is the absence of family size from both the graphical and regression tree analysis. On average, family size is homogeneous throughout the country and of no importance in determining the state MOS fill rate. Finally, Youth Attitude Tracking Survey (YATS) data fails to predict regional MOS fill rates. The results from the YATS survey do not translate into higher fill rates. While possibly a good indicator for active duty accessions, it appears to provide little information on future reserve accessions.

C. RUC PERSONNEL ANALYSIS

The analysis finally focuses on personal attributes of individuals within similar RUCs. The analysis discovers wide variations between RUCs and regions in almost every studied attribute. The study explores factors that might indicate a homogeneous population at the regional level and identify what regions might be similar. The RUCs fail to represent a homogeneous population across all of the explored factors. Region 4 is not considered in the differences between RUCs within a region analysis because it only contains one of the analyzed RUCs in this portion of the analysis. The analysis uses

Region 4 in all of the chi-square tests performed on regions with homogeneous RUCs. Table 9 summarizes the findings.

Table 9: RUC Personnel Analysis Results

Variable	DIFFERENCE BETWEEN RUCs			DIFFERENCE IN REGIONS WITH HOMOGENEOUS RUCS
	REGION 1	REGION 2	REGION 3	
SATYRS	NO	NO	NO	NO
AFQTPER	NO	YES	NO	NO
AFQTCAT	NO	YES	NO	NO
AGE	NO	YES	YES	NO
DEPNS	NO	NO	NO	YES
MARITAL	NO	NO	NO	YES
RETPTS	NO	YES	YES	NO
RETPTSC	NO	NO	NO	NO
YOS	NO	NO	YES	NO
TRNCAT	NO	NO	NO	NO
RACETHN	YES	YES	NO	YES
MGBSTAT	NO	NO	YES	NO

Except for racial makeup (RACETHN), Region 1 displays a fairly homogeneous makeup of personnel within the region. Policy decisions should affect each RUC within Region 1 similarly provided the policy is not designed to affect racial recruitment. In fact, racial policy decisions appear to have local community implications throughout the country. The local community environment will play a much larger role in influencing prospective recruit behavior for this factor.

Region 2 shows the most variability between RUCs. These RUCs display variation within the Region in two important factors: AFQT percentile (AFQTPER) and AFQT category (AFQTCAT). One RUC does have a lower AFQTCAT mix then the other two. Its close proximity to a major metropolitan area, Chicago, probably explains this trend. The individuals with better education have a larger number of job or educational opportunities and are deciding not to join the SMCR. Again, depending on the policy incentive, USMC planners should consider local demographics. From a career standpoint the RUCs are a homogeneous mix, however during the last fiscal year some variation does occur between RUCs. This variation might be an early indication of significant manning level shifts in the future.

Region 3 displays the some variability between RUCs. Of particular interest are the differences in age (AGE), yearly retirement points (RETPTS), and years of service (YOS). All of these factors are indicators of career intentions. These attributes appear to be even more localized possibly down to the local community level for this region. It appears it is even more imperative to understand local population attitudes when determining future policy decisions to influence the career reserve force.

Region 4's behavior is inferred by looking at the fifth column of Table 8. This RUC is considered in every combination of those regions considered homogeneous in the particular attribute. Region 4 is different from the rest of the country in the dependents (DEPNS) and marital (MARITAL) factors. The large Hispanic and Asian populations in several of the western states account for its racial difference with the rest of the regions. This racial difference may translate into cultural differences that may in turn explain the dependent and marital differences found with the rest of the country. Due to the vast area

and diverse cultural backgrounds of the states in Region 4, policy decisions should take local variations no higher than the state level into particular account before establishing new recruitment incentives.

D. MGIB STIPEND POLICY IMPLICATIONS

The study identifies numerous MOSs that are chronically short in every geographical location throughout the US. While the USMC SMCR appears to be healthy from a total numbers manning level, there are numerous problems in adequately filling MOSs in the RUCs. As an incentive to change to or enlist in a chronically short MOS, the Montgomery GI Bill (MGIB) Stipend should be beneficial. However, it does not appear to be the perfect solution.

Headquarters, USMC (HQMC) Manpower & Reserve Affairs (M&RA) for Reserve Affairs should target the MGIB Stipend no higher than the state level but usually at the RUC level. Additionally, units that contain a higher percentage of Armed Forces Qualification Test (AFQT) percentile and category I and II Marines are optimum targets for the incentive. These contain the individuals who are more likely to desire this type of enlistment or reenlistment incentive. Additionally, these Marines indicate the existence of a local population that may be enticed by this incentive for reserve enlistment. M&RA for Reserve Affairs should target the MGIB Stipend towards junior Marines and civilians in communities where higher level education opportunities exist but local income and the number of moonlighting opportunities are low.

It is doubtful the stipend will have a strong recruiting effect for the Reserve Forces in large inner cities. The individuals in these labor pools are more likely to find other job opportunities to supplement income or join the active military forces in order to

escape their present economic condition. Region 2 seems to be the best candidate for the MGIB Stipend targeted at the RUC level. The region displays significant RUC variation in the percentage of AFQT Category I and II individuals as well as the AGE, RETPTS, and RACETHN variables. The type of individual who scores high on the AFQT and is career oriented might take advantage of the incentive and successfully transition into a chronically short MOS and continue to serve for a number of years. Studies by Gee and Nelson (1995) support this position.

Additionally, Headquarters, USMC M&RA for Reserve Affairs should develop an alternative recruitment incentive to the MGIB Stipend. The proposed incentive will not produce the desired numbers of recruits for the SMCR in every geographic location where current chronically short MOSs exist. The opportunity for higher education may not exist, or the individual might be looking to earn extra money in order to make ends meet. This might be the situation for RUCs in Regions 3 and 4. The majority of the states in both regions have larger rural populations, higher unemployment with fewer job opportunities, fewer higher educational opportunities, and larger household size. Therefore, a monetary enlistment incentive should result in higher reserve enlistment. Work by Goldberg (1985), Krishman (1990) and Tan (1991) all support this position.

E. RECOMMENDATIONS FOR FURTHER STUDY

Further research in the area of demographic influences on retention and enlistment is required to further investigate the trends identified in this study. The identified personal trends are valid for reserve weapons companies. Of interest is if these trends continue over all reserve RUCs regardless of mission, size and MOS and if they are the result of local demographic factors. Additionally, what influences these factors

have on the reserve enlistment or reenlistment decision, and how enlistment incentives influence the individual's decision process are of interest.

Several areas, such as Southern California and the District of Columbia, contain multiple reserve units or RUCs in close proximity to one another. While these units are diverse with differing operational missions and T/O's, most of the RUC's T/O's do have some similar MOS requirements that are filled at various levels. Further research in developing optimization models that increase overall manning levels for particular MOSs in a geographic location might reduce the number of chronically short MOSs in the area thereby increasing overall force readiness.

APPENDIX A. DMDC DATA FIELDS

SBN FIELD: 3 **SBN POSITION:** 5-13	**DATA ELEMENT:** SOCIAL SECURITY NUMBER	**POSITION 1**
SBN CODING: 9 NUMERIC	**EDIT CODING:** 4 BYTE BINARY	**EDIT POSITIONS:** 1- 4

FIELD EDITING: Submission values are edited/converted to edited using the below criteria:

1. Must be a nine position numeric field in the submission file.

2. A range parameter test is performed to validate against the current (released monthly) social security valid range guidelines.

3. Record may not be a duplicate within a single master file. (A single master file is one of the 14 submitted master files - 7 components, Enlisted & Officer) - duplicates do exist between these 14 submitted component master files as a consequence of delayed loss reporting.

4. Should record fail test 1 above, the SSN is listed as a bad field on the monthly Edit report and the record is rejected. Should record fail test 2 above, the SSN is listed on the monthly Edit report as SSN Out of Range, but not rejected. Should a master file record fail test 3 above, the SSN is listed as a bad field on the monthly edited report and the record is rejected.

DATA ELEMENT HISTORY/VALIDITY: Data element is 100% valid for each record for all time frames. Detection of an invalid SSN can cause record rejection.

SBN FIELD: 18 **SBN POSITION:** 161-163	**DATA ELEMENT:** PAY GRADE	**POSITION 13**
SBN CODING: 3 CHAR	**EDIT CODING:** 1 BYTE BINARY	**EDIT POSITIONS:** 13

FIELD EDITING: This field is checked to insure that the first position is an alpha character and that the next two positions are numeric. Some allowances are made for incorrect formats:

- If the first position is a zero (0) and the file being edited is an officer submission, then the zero is converted to an 'O'.
- If the first position is not E or W or O, then it is converted to either E or O depending upon what type of file is being edited (officer or enlisted).

EDITED FILE CODE STRUCTURE:

00 ENLISTED UNKNOWN
01-09 ENLISTED E01-E09
10 WARRANT UNKNOWN
11-15 WARRANT W01-W05
20 OFFICER UNKNOWN
21-30 OFFICER O01-O10

DATA ELEMENT HISTORY/VALIDITY: This field is a 100% correct data element.

SBN FIELD: 26 SBN POSITION: 191-198	DATA ELEMENT: PRIMARY SERVICE OCCUPATION CODE	POSITION 33
SBN CODING: 8 CHAR	EDIT CODING: 8 CHAR	EDIT POSITIONS: 33-40

FIELD EDITING: If the 1st three positions equal WWW (Not Applicable) or ZZZ (Unknown), then move spaces to output, otherwise pass field to output.

DATA ELEMENT HISTORY/VALIDITY:

THIS DATA ELEMENT IS THE SERVICE CODE FOR THE MEMBER'S PRIMARY OCCUPATION. IT IS STORED IN ITS ORIGINAL FORM WITH NO RECODING AND NO EDITING (SEE POSITION 198 FOR VALIDITY). THIS ELEMENT IS CODED AS FOLLOWS:

ARMY ENLISTED - MOS IS IN 1-3; SKILL LEVEL IS IN 4; SQI IS IN 5; ASI IS IN 6-7 FOR USAR FILES 8808/LATER AND ARNG FILES 8809/LATER

ARMY WARRANT OFFICER - MOS IS IN 1-4 WITH POSSIBLE SKILL LEVEL IN POSITION 5

ARMY COMMISSIONED OFFICER - SSI IS IN 1-3. THE QUALITY IS GOOD FOR SELRES EXCEPT FOR USAR AGR. ASI IS IN 4-5 BUT IS HIGHLY SUSPECT. SKILL OR LANGUAGE IS IN 6-7 BUT IS ALSO HIGHLY SUSPECT

NAVY ENLISTED - RATING IS IN 1-3; NEC IS IN 5-8. THERE ARE CASES WHERE THESE DO NOT AGREE. THE DODOCC IS GENERATED USING THE NEC WHERE POSSIBLE.

NAVY OFFICER - PRIOR TO 8705 NOBC IS IN 1-4; BEGINNING IN FY87, THE DESIGNATOR IS IN 1-4 AND AQD IN 5-7; BEGINNING IN 8805, MEDICAL PERSONNEL HAVE DESIGNATOR IN 1-4 AND SUBSPECIALTY IN 5-8

MARINE ENLISTED - MOS IS IN 1-4 (NUMERIC)

MARINE OFFICER - MOS IS IN 1-4 (NUMERIC)

AIR FORCE ENLISTED - AFSC IS IN 2-6; 1 AND 7 MAY CONTAIN ADDITIONAL SKILL IDENTIFIERS

AIR FORCE OFFICER - AFSC IS IN 2-5; 1 AND 6 MAY CONTAIN ADDITIONAL SKILL IDENTIFIERS

COAST GUARD ENLISTED - RATING AND QUALIFICATION CODE

COAST GUARD OFFICER - OFFICER EXPERIENCE INDICATOR

SBN FIELD: 46 SBN POSITION: 251-258	DATA ELEMENT: ASSIGNED UNIT IDENTIFICATION CODE	POSITION 69
SBN CODING: 8 CHAR	EDIT CODING: 8 CHAR	EDIT POSITIONS: 69-76

DoD INSTRUCTION: Enter UIC of Reserve unit to which Service member is assigned. If UIC where Service member is actually performing duty is different, then, also enter data in record field 101. (Marine Corps to submit Reporting Unit Code (RUC) and Monitored Command Code (MCC), Air Force to submit PAS Code, Army to submit 6 position UIC.) An IMA shall carry the UIC of the unit to which they are assigned. If not applicable, set I = WWWWWWWW. If unknown, set I = ZZZZZZZZ

NOTE: USAR AGR have no UIC until FY86.

FIELD EDITING: If the 1st 5 positions of input are 00000,99999,WWWWW or ZZZZZ then output is blank filled. If the 1st 6 positions of input are alpha or character and component is either ARNG or USNR then move 1st 6 positions to output. If the 1st 6 positions of input are alpha or character and component is USAR move entire input to output. If the 1st 5 positions of input are alpha or character and the component is USMCR then move 1st 5 positions to output. If the 1st 8 positions of input are alpha or character and component is USAFR or ANG then move input to output. If the 1st 7 positions of input are alpha or character and component is USCGR move 'P' & 1st 7 positions to output.

DATA ELEMENT HISTORY/VALIDITY: The actual unit to which a member is assigned. Especially in the case of the ARNG this may not be the unit he is physically drilling with. This element has been restructured to be compatible with the UIC address file.

SBN FIELD: 11 SBN POSITION: 60	DATA ELEMENT: MARITAL STATUS	POSITION 22
SBN CODING: 1 CHAR	EDIT CODING: 1 BYTE BINARY	EDIT POSITIONS: 22

CAUTION: On files earlier than 8610, a blank was coded as single (6).

FIELD EDITING: Submission values are converted to edited values according to the following table:

Edit code	Submission Code	Description
1	A	Annulled
2	D	Divorced
3	I	Interlocutory
4	L	Legally Separated
5	W	Widowed
6	S	Single
7	M	Married
0	0, Z, Blank	Unknown

DATA ELEMENT HISTORY/VALIDITY:

SBN FIELD: 12 SBN POSITION: 61-62	DATA ELEMENT: NUMBER OF DEPENDENTS	POSITION 23
SBN CODING: 2 NUMERIC	EDIT CODING: 1 BYTE BINARY	EDIT POSITIONS: 23

DoD Instruction: The number of persons for whom the Service member provides support. (Report only those eligible to be included on the DD Form 1172, "Application for Uniformed Services Identification and Privilege Card"). If not applicable, set I = 66. If unknown, set I = 99.

NOTE: This is the actual number of dependents and does not include the member (sponsor).

FIELD EDITING: Submission values are converted to edited values according to the following table:

If value is 66, fill output with 99.
If value is 99, fill output with 99.
If value is not numeric or more than 20, fill output with 99.
If value is numeric and less than 11, move input to output.
If value is numeric and more than 10, move 11 to output.

DATA ELEMENT HISTORY/VALIDITY:

SBN FIELD: N/A SBN POSITION: N/A	DATA ELEMENT: AGE	POSITION 24
SBN CODING: N/A	EDIT CODING: 1 BYTE BINARY	EDIT POSITIONS: 24

FIELD EDITING: This field is **generated** and requires a valid Date of Birth and File PARM card date. For transaction records a valid Date of Birth and transaction effective date is required. After the transaction date is validated, it is checked with the PARM date insuring that a valid transaction date cannot be in the past more than 10 years, or greater than one year in the future. All dates used are converted to months. Date of Birth months are subtracted form the PARM date (or transaction effective date) and multiplied by 12.

DATE RANGE: Must not be less than 16, or more than 70. If out of range, the output is zero filled.

DATA ELEMENT HISTORY/VALIDITY:

SBN FIELD: N/A SBN POSITION: N/A	DATA ELEMENT: RACE/ETHNIC	POSITION 26
SBN CODING: N/A	EDIT CODING: 1 BYTE BINARY	EDIT POSITIONS: 26

CAUTION: This derived race/ethnic field has no statutory or regulatory base. It is constructed for DMDC use only.

FIELD EDITING: This edited field is **generated** using values in the following submission fields:

Race (position 58)
Ethnic group (position 59)

CAUTION: The values for race are altered for this process and are listed below:

0 = UNKNOWN
1 = WHITE
2 = BLACK
3 = HISPANIC
4 = NATIVE AMERICAN
5 = ASIAN
6 = OTHER

CAUTION: The values for edited ethnic codes are altered for this process and are listed below:

If edited ethnic code is more than 0 and less than 6, fill output with 3.
If edited ethnic code is more than 5 and less than 9, fill output with 4.
If edited ethnic code is more than 8 and less than 20, fill output with 5.
If edited ethnic code equals 22, fill output with 5.
If edited ethnic code equals 20 and race equals 0, fill output with 6.

The derived race/ethnic code is passed to the edited file based upon the following table:

RACE/ETHNIC CODE		RACE	ETHNIC
1	WHITE	C	X,Y,Z,BLANK
2	BLACK	N	X,Y,Z,BLANK
3	HISPANIC	ANY	6,4,9,S,1
4	AMER IND/ALASKAN	R	X,Y,Z,BLANK
	"	ANY	8,7,2
5	ASIAN/PAC ISLAND	ANY	G,J,K,H,D,5,V,3
	"	ANY	E,W,L,Q
	"	M	X,Y,Z,BLANK
6	OTHER	X	X,Y,Z,BLANK
	"	Z,BLANK	X
0	UNKNOWN/NONE	Z,BLANK	Y,Z,BLANK

DATA ELEMENT HISTORY/VALIDITY:

SBN FIELD: 40 SBN POSITION: 243-244	DATA ELEMENT: ENLISTED AFQT SCORE GROUP CODE	POSITION 31(E)
SBN CODING: 2 CHAR	EDIT CODING: 1 BYTE BINARY	EDIT POSITIONS: 31

CAUTION: This field has changed over time.

CAUTION: Code 11 valid only for ARNG in Alaska & and only for Eskimo Scout personnel.

FIELD EDITING: AFQT Score Group Code applies to enlisted personnel only. The Armed Forces Qualification Test (AFQT) Percentile Score is used to generate this field.
If the AFQT Score is numeric with a value range of 01-99, then move appropriate AFQT Score Group Code to output, based on the table below.
If the AFQT Score is WW, move 11 to output.
If the AFQT Score is ZZ, move 0 to output.
Otherwise, fill output with zero.

CODE	AFQT SCORE GROUP CODE	AFQT SCORE RANGE
1	Category V	01-09
2	Category IVC	10-15
3	Category IVB	16-20
4	Category IVA	21-30
5	Category IV	n.a.
6	Category IIIB	31-49
7	Category IIIA	50-64
8	Category III	n.a.
9	Category II	65-92
10	Category I	93-99
11	Not applicable	WW
0	Unknown	ZZ

NOTE: Codes 1,5,8 are valid only prior to FY87; codes 2, 3, 4, 6, and 7 are valid only for FY87 and later. Coding of retiree records is not required.

DATA ELEMENT HISTORY/VALIDITY:

This field is generated as submission value is in the form of a percentile (01% to 99%) and is converted to the appropriate category.

SBN FIELD: 40 **SBN POSITION:** 243-244	**DATA ELEMENT:** ENLISTED AFQT PERCENTILE	**POSITION 32(E)**
SBN CODING: 2 CHAR	**EDIT CODING:** 1 BYTE BINARY	**EDIT POSITIONS:** 32

DoD INSTRUCTION: (Armed Forces Qualification Test (AFQT) Percentile Score (Enlisted Only))
Report AFQT percentile score, or equivalent. If the score on a classification test is available instead, convert classification test score to an AFQT percentile score and provide a description of the conversion method. Convert percentile scores of 100 to 99. If not applicable, set I = WW. If unknown, set I = ZZ.

FIELD EDITING: AFQT percentile applies to enlisted personnel only.
If the submission value is numeric with a value range of 1-99, value is moved to output.
If the submission value is WW, move 0 to output.
If the submission value is ZZ, move 0 to output.
Otherwise, fill output with zero.

DATA ELEMENT HISTORY/VALIDITY:

Armed Forces Qualification Test score in percentile form (1% to 99%)

CAUTION: PRIOR TO APRIL 1992 THIS FIELD WAS 'ENLISTED TERM OF ENLISTMENT'

This was coded in terms of Selected Reserve years as reported in submission position
248, 249, or 250. If any of the fields were populated they were then used to fill this field

1-8 Years of SelRes Commitment
9 - indefinite contract
99 - unknown/invalid/not applicable

SBN FIELD: 84/88 **SBN POSITION:** 372-373 / 385	**DATA ELEMENT:** NOTIFICATION OF RETIREMENT ELIGIBILITY / YRS FOR RETIREMENT	**POSITION 21**
SBN CODING: NUMERIC	**EDIT CODING:** 1 BYTE BINARY	**EDIT POSITIONS:** 21

FIELD EDITING: This field is **generated** from the following submission fields:
Number of years creditable for Reserve retirement (submission position 372-373).
Notification of eligibility for Military Retirement Pay Indicator (submission position 385).

This edited field is constructed based upon the number of years creditable for Reserve retirement multiplied by the value in position 385 (notification of eligibility). The number of creditable years for retirement is a value from 0 to 50. Records where eligibility for retirement has been verified and letters of notification have been issued are coded as a 1 in the submission record. Other records are coded as 0 in the submission record. An example of this calculation would be: a record with 22 creditable years for retirement, **with** notification of eligibility, would be coded as 122; conversely a record with 22 creditable years, **without** notification of eligibility, would be coded as 22.

Both of these submission fields must be numeric. The number of years creditable for Reserve retirement must be a value between 0 and 50 or the edited field is set to 98. If notification of eligibility for Military Retirement Pay Indicator does not contain a 1, notification of eligibility is set to zero in the edited record.

DATA ELEMENT HISTORY/VALIDITY:

SBN FIELD: N/A SBN POSITION: N/A	DATA ELEMENT: YEARS OF MILITARY SERVICE	POSITION 85
SBN CODING: N/A	**EDIT CODING:** 1 BYTE BINARY	**EDIT POSITIONS:** 85

NOTE: This is not the same field as Year of Service on the Active Duty Files and should not be used as such.

FIELD EDITING: This field is **generated** by subtracting PEBD from the file date on master file records and the transaction effective date on transaction file records. This represents the total years of service as differentiated from Years of Active Duty or Years for Retirement. The following values are calculated and code as depicted below

00	Less than 1 Year of Service
01-40	1 to 40 Years of Service
41	More than 40 Years of Service
99	Unknown or Invalid

DATA ELEMENT HISTORY/VALIDITY:

SBN FIELD: 85 **SBN POSITION:** 374-376	**DATA ELEMENT:** TOTAL POINTS EARNED LAST RETIREMENT YR	**POSITION 121**
SBN CODING: 3 NUMERIC	**EDIT CODING:** 2 BYTE BINARY	**EDIT POSITIONS:** 121-122

NOTE: Required only on Fiscal year end master files. Reporting is optional for AGR. 15 gratuitous points are awarded all Ready Reserve members. ARNG began reporting in FY89.

FIELD EDITING: Submission values are converted to edited values according to the following criterion:

0 -366 Valid input and is passed to edited field.
888 If 666 (Not Applicable) & SG,PJ,PK or Retired.
998 Non-numeric or invalid
999 367 OR GREATER

DATA ELEMENT HISTORY/VALIDITY:

SBN FIELD: 87 **SBN POSITION:** 380-384	**DATA ELEMENT:** TOTAL POINTS EARNED IN TOTAL CAREER	**POSITION 125**
SBN CODING: 5 NUMERIC	**EDIT CODING:** 2 BYTE BINARY	**EDIT POSITIONS:** 125-126

Note: Required only of Fiscal year end master files. Reporting is optional for AGR. ARNG reported data on only a few states during FY88 which was their 1st year reporting; the balance of the reserve components began reporting in 8811. USAR's initial reporting is believed not to be current.

FIELD EDITING: Submission values are converted to edited values according to the following criterion:

0 -13000	Valid range and is passed to edited field
31666	IF 66666 (Not Applicable) & SG,PJ,PK or Retired.
31999	Greater than 13000
99998	Invalid or non numeric

DATA ELEMENT HISTORY/VALIDITY:

SBN FIELD: 87 **SBN POSITION:** 380-384	**DATA ELEMENT:** TOTAL POINTS EARNED IN TOTAL CAREER	**POSITION 125**
SBN CODING: 5 NUMERIC	**EDIT CODING:** 2 BYTE BINARY	**EDIT POSITIONS:** 125-126

Note: Required only of Fiscal year end master files. Reporting is optional for AGR. ARNG reported data on only a few states during FY88 which was their 1st year reporting; the balance of the reserve components began reporting in 8811. USAR's initial reporting is believed not to be current.

FIELD EDITING: Submission values are converted to edited values according to the following criterion:

0 -13000	Valid range and is passed to edited field
31666	IF 66666 (Not Applicable) & SG,PJ,PK or Retired.
31999	Greater than 13000
99998	Invalid or non numeric

DATA ELEMENT HISTORY/VALIDITY:

SBN FIELD: 76 SBN POSITION: 339	DATA ELEMENT: MGIB ELIGIBILITY STATUS	POSITION 236
SBN CODING: 1 CHAR	EDIT CODING: 1 CHAR	EDIT POSITIONS: 236

DoD INSTRUCTION: Chapter 106 of reference (b) and DoD INSTRUCTION 1322.17 (references (p)).
If not applicable, set I = W. If unknown, set I = Z.

Field Editing: All values, other than those listed below, will be coded as Z in the edited output.
If one of below values, move to edited output.

Code	Description
A	Ineligible - Service member has not executed a 6-year obligation in the Selected Reserve after Sept 30, 1990. This code becomes not applicable for members of the SELRES effective July 1, 1994. (Used for historical purposes.)
B	Ineligible - Service member in receipt of an ROTC scholarship.
C	Ineligible - Service member has not executed a 6-year enlistment/re-enlistment or extension of service in the Selected Reserve after June 30, 1985.
D	Ineligible - Service member has executed a 6-year enlistment/re-enlistment or extension of service in the SELRES after June 30, 1985, but has not completed IADT as prescribed by the Secretary of the Military Department (includes split training option).
E	Ineligible - Service member did not receive a secondary school diploma (or equivalency certificate) before completion of IADT (NPS) or before execution of a 6-year enlistment/re-enlistment or extension of service in the Selected Reserve. (PS).
F	Eligible - meets the eligibility criteria under reference (b).
G	Ineligible - correction of erroneous report of eligibility. No recoupment required.
H	Eligibility terminated - Service member has been determined to be an unsatisfactory participant or performer.
I	Eligibility terminated - Expiration of 10 year eligibility period.
J	Eligibility terminated - Service member has completed a course of instruction required for the award of a baccalaureate degree or equivalent degree and has not executed a 6-year obligation in the SELRES after Sept 30, 1990. Not utilized for personnel who were accessed after Sept 30, 1990. Code obsolete effective July 1, 1994.
K	Eligibility terminated - Service member in receipt of an ROTC scholarship.
L	Eligibility terminated - Service member died, Service member separated, or transferred from the Selected Reserve.
M	Eligibility suspended - Service member awaiting final determination of unsatisfactory participation or performance.
N	Eligibility suspended - Service member has been granted a period of authorized non-availability (missionary), up to 3 years.
P	Eligibility suspended - Service member has been granted a period of authorized non-availability

Code	Description
	(all others) of up to one year.
Q	Eligibility reinstated - Service member has reaffiliated with the Selected Reserve following a period of authorized non-availability.
R	Eligible - disability not the result of individual's willful misconduct.
S	Ineligible - Eligibility terminated FTS and/or AGR who gained entitlement to the MGIB, on or after, Nov 29, 1989, are not eligible for Chapter 106 of reference (b).

APPENDIX B. MOS ANALYSIS FUNCTIONS

```
function(chronicRUCTO)
{
#This function (ConvertRucTO) converts the reserve RUC T/O to a data
# frame to be used in the ChronicComparev2 function to
# determine what MOSs in a particular RUC are short.
# ChronicRUCTO is a matrix generated from an Excell
# spreadsheet ahowing each RUC, the MOS, and the number
# of enlisted Marines by rank.
      ruc <- chronicRUCTO
      dimnames(ruc) <- list(NULL, ruc[1,  ])
      ruc <- ruc[-1,  ]
      ruc.num <- ruc[, 5:11]
      ruc.num <- matrix(as.numeric(ruc.num), ncol = 7)
      dimnames(ruc.num) <- list(NULL, dimnames(ruc)[[2]][5:11])
      ruc.name <- ruc[, c(1, 3)]
      rucTO.df <- data.frame(Ruc = I(ruc.name[, "RESRUC"]), PMOS =
I(ruc.name[, "BMOS"]), ruc.num)
      return(rucTO.df)
}
```

```
function(ChronicData, ID)
{
# This function (ConvertChronicData) converts the individual chronic
data file into the
# proper format to be used in the chronic.compare function.
# The function takes a matrix created from a tab delimited Excell
# spread sheet and converts it into a table for use in the
chronic.compare function.
	col.names <- dimnames(ChronicData)[[2]]
	if(length(col.names) == 0 || !any(col.names == "PMOS")) {
		dimnames(ChronicData) <- list(NULL, ChronicData[1,  ])
		ChronicData <- ChronicData[-1,  ]
	}
	bads <- ChronicData[, "GRADE"] < "01" | ChronicData[, "GRADE"] >
"09"
	if(any(bads)) {
		warning("Some screwy ranks found and deleted in ruc!\n")
		ChronicData <- ChronicData[!bads,  ]
	}
	chronic.eq.go <- ChronicData[, 1] == ID
	if(!any(chronic.eq.go)) {
		cat("Warning: no data found for ruc ", ID, "\n")
		return(NULL)
	}
	result <- table(ChronicData[chronic.eq.go, "PMOS"],
ChronicData[chronic.eq.go, "GRADE"])	#
#
# If result doesn't have 9 columns, create a new item with 9 columns
# and put result into it in the proper way.
#
	if(ncol(result) != 9) {
		result2 <- matrix(0, nrow(result), 9)
		dimnames(result2) <- list(dimnames(result)[[1]], paste("0",
1:9, sep = ""))
		result2[, dimnames(result)[[2]]] <- result
		return(result2)
	}
	else return(result)
}
```

```
function(t1, ruc.tbl, ruc, debug = F)
{
#
# ChronicComparev2: compare the actual allocations (from
# table "t1") to the t/o allocations (in "ruc"). Return
# one number per MOS describing how far away from the t/o
# this ruc is for that MOS.  This differs from Chronic.compare in
# that it it makes adjustments to the O/H vector of strengths
# as it goes along and not the difference vector (d) between the O/H
# and T/O vectors.
#
# Arguments: t1: table of actual. This has one MOS per row,
# one grade per column. E1-E3 may have separate columns, and
# we need to aggregate them.
#       ruc.tbl: t/o table. This also has one MOS per row,
# one grade per column except that E1-E3 have been combined.
#             ruc: ruc of interest
#
# First make sure t1 has 9 columns. If so, combine the 01, 02,
# and 03 columns.
#
      if(ncol(t1) != 9) stop("t1 table didn't have 9 columns. Too
bad.")      #
      names.t1 <- dimnames(t1)[[2]]
      if(any(names.t1 == "01"))
            t1.comb <- t1[, "01", drop = F]
      else t1.comb <- matrix(rep(0, nrow(t1)), ncol = 1)
      if(any(names.t1 == "02"))
            t1.comb <- t1.comb + t1[, "02", drop = F]
      if(any(names.t1 == "03")) t1.comb <- t1.comb + t1[, "03", drop =
F]    #
      not.e1.e2.or.e3 <- names.t1 != "01" & names.t1 != "02" & names.t1
!= "03"     #
      if(sum(not.e1.e2.or.e3) != 0)
            t1 <- cbind(t1.comb, t1[, not.e1.e2.or.e3, drop = F])
      dimnames(t1)[[2]][1] <- "E13REQ"
      dimnames(t1)[[2]][-1] <- paste("E", substring(dimnames(t1)[[2]][-
1], 2, 2),
            "REQ", sep = "")  #
#
# Reduce the ruc.table so that it refers only to this ruc.
#
      ruc.tbl <- ruc.tbl[ruc.tbl[, "Ruc"] == ruc,  ]  #
# Eliminate from t1 any MOSs that don't appear in Ruc.
#
      good <- as.logical(match(dimnames(t1)[[1]], ruc.tbl[, "PMOS"],
0))   #
      t1 <- t1[good,  , drop = F]   #
#
# At this stage, we have both tables where we want them. Set up
# the result, which gives the percentage short in each MOS. Make
# every entry 0% to start with -- this handles the MOSs in the
# ruc table that don't show up in t1.
#
      result <- rep(0, nrow(ruc.tbl))     #
      names(result) <- ruc.tbl[, "PMOS"]
```

```
      t1.MOSs <- dimnames(t1)[[1]]  #
      compare.lines <- function(v1, v2, debug = debug)
      {
#
# Comparison function. v1 is the "actual" and v2 is the t/o.
#
#
# If v1 and v2 are not the same length, restrict v1 to have the
# same names as those that appear in v2.
#
            if(length(v1) != length(v2)) {
                  matchers <- as.logical(match(names(v1), names(v2),
0))
                  v1 <- v1[matchers]
            }
# The next two lines are form the first chronic.compare
#           d <- v1 - v2
#           if(all(d >= 0)) return(100)   #
#
# Loop through the vector of differences...
#
            a <- 1
            if(all(v1 < v2))
                  return(100)
            while(a < 8) {
                  d <- v1[a] - v2[a]
                  if(debug)
                        cat("Top: a is ", a, ", d is ", d, ", v1 is ",
v1,
                          "\n")
                  if(d >= 0) {
                        v1[a] <- d
                        a <- a + 1
                        next
                  }
                  if(debug == T)
                        cat("v1 is now ", v1, "\n")
                  if(d < 0 && a > 2 && v1[a - 2] > 0) {
                        z <- min( - d, v1[a - 2])
                        d <- d + z
                        v1[a] <- d
                        v1[a - 2] <- v1[a - 2] - z
                        if(debug == T) {
                          cat("change 1: v1 is now ", v1, "\n")
                          browser()
                        }
                  }
                  if(d < 0 && a > 1 && v1[a - 1] > 0) {
                        z <- min( - d, v1[a - 1])
                        d <- d + z
                        v1[a] <- d
                        v1[a - 1] <- v1[a - 1] - z
                        if(debug == T) {
                          cat("change 2: v1 is now ", v1, "\n")
                          browser()
                        }
```

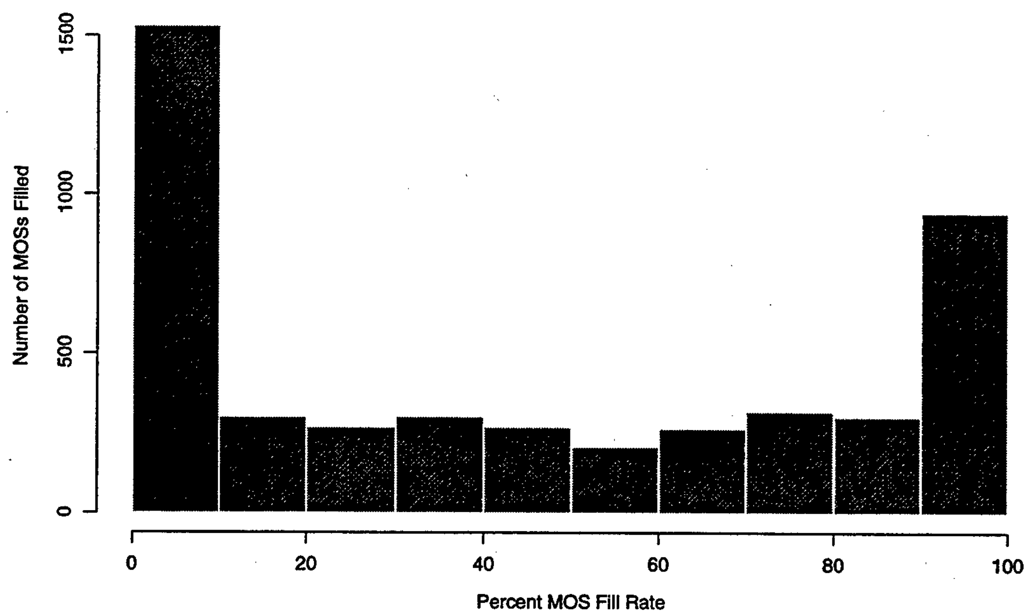
```
                  }
                  if(d < 0 && a < 7 && v1[a + 1] > 0) {
                        z <- min( - d, v1[a + 1])
                        d <- d + z
                        v1[a] <- d
                        v1[a + 1] <- v1[a + 1] - z
                        if(debug == T) {
                          cat("change 3: v1 is now ", v1, "\n")
                          browser()
                        }
                  }
#
#
# If d is still negative, make v1 reflect that.
#
                  if(d < 0)
                        v1[a] <- d
                  a <- a + 1
            }
            if(debug == T)
                  cat("Final v1 is ", v1, "\n")
            return(100 - (((100 * abs(sum(v1[v1 < 0]))))/sum(v2)))
      }
#
#
# Handle case where Ruc doesn't exist?
#
      if(nrow(ruc.tbl) == 0) return(result)     #
#
# Handle case where none of the remaining MOSs is in the ruc.
#
      if(length(t1.MOSs) == 0)
            return(result)
      for(i in 1:nrow(ruc.tbl)) {
            if(length(ruc.tbl[i, "PMOS"]) == 0)
                  next
            if(any(t1.MOSs == ruc.tbl[i, "PMOS"])) {
                  which <- (1:length(t1.MOSs))[t1.MOSs == ruc.tbl[i,
"PMOS"]]     #
                  if(debug) {
                        cat("About to compare for ruc row ", i, "\n")
      #
                        browser()
                  }
                  this.result <- compare.lines(t1[which,  , drop = F],
ruc.tbl[i,
                        c(-1, -2), drop = F], debug = debug)
                  result[i] <- this.result
            }
      }
      return(result)
}
```

```
function(which = 101:148)
{
#
# Combine(): find the sum across all the matrices
# of the form "c<i>eval" where i is in "which." This
# presumes that each of these matrices will be of
# the same size. The return value is one more matrix
# of that size giving the sum, across matrices, of
# the constituents.
#
	first.time <- T
	for(i in which) {
		name <- paste("c", i, "eval", sep = "")
		if(!exists(name)) {
			warning(paste("No object named ", name,
				", skipping...\n"))
			next
		}
		cat("Dealing with matrix ", name, "\n")
		obj <- get(name)
		if(first.time) {
			result <- obj > 70
			res.ct <- matrix(1, nrow(result), ncol(result)
				)
			res.ct[is.na(result)] <- 0
			remove("obj", frame = sys.nframe())
			first.time <- F
			next
		}
		obj <- obj > 70
		nas <- is.na(obj)
		result[obj & !nas] <- result[obj & !nas] + 1	#
#
# Now to get the percentage of time a particular MOS in a certain RUC
meets fill requirement.
#
		res.ct[!nas] <- res.ct[!nas] + 1
		remove(c("nas", "obj"), frame = sys.nframe())
	}
	result <- 100 * (result/res.ct)
	return(result)
}
```

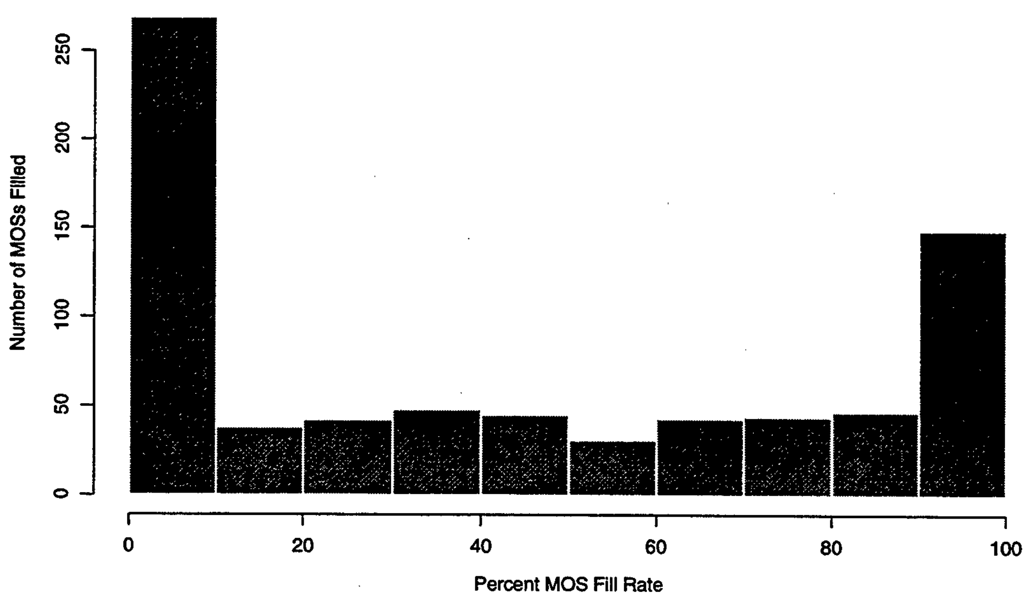
```
function(shortMatrix)
{
#
# CreateShortRucList() is a function that takes the MOS
# shortage matrix created by Combine().  The function
# then manipulates the matrix in order to produce a
# list of short MOSs by RUCs.
#
      matrix <- t(shortMatrix)
      matrix <- cbind(dimnames(matrix)[[1]][row(matrix)],
dimnames(matrix)[[2]][col(
            matrix)], c(matrix))
      dimnames(matrix) <- list(NULL, c("Ruc", "Mos", "Shortage"))
      matrix <- matrix[matrix[, "Shortage"] != "NA",  ]      #
      short <- as.numeric(matrix[, "Shortage"])
      return(data.frame(Ruc = I(matrix[, 2]), MOS = I(matrix[, 1]),
            Shortage = short))
}
```

APPENDIX C. CHRONIC RESULTS HISTOGRAMS

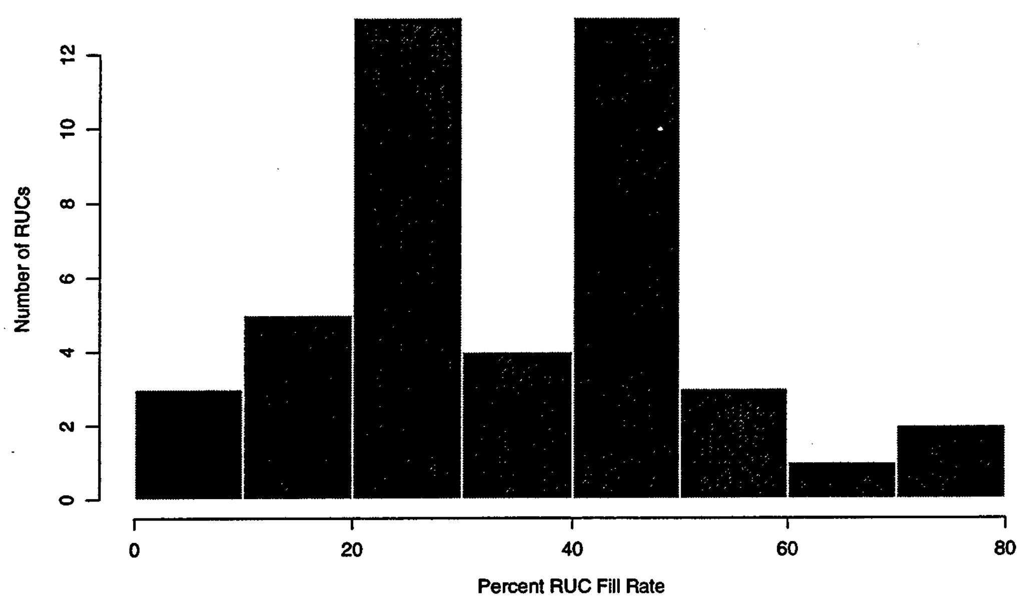
USMCR ACTUAL MOS FILL RATE



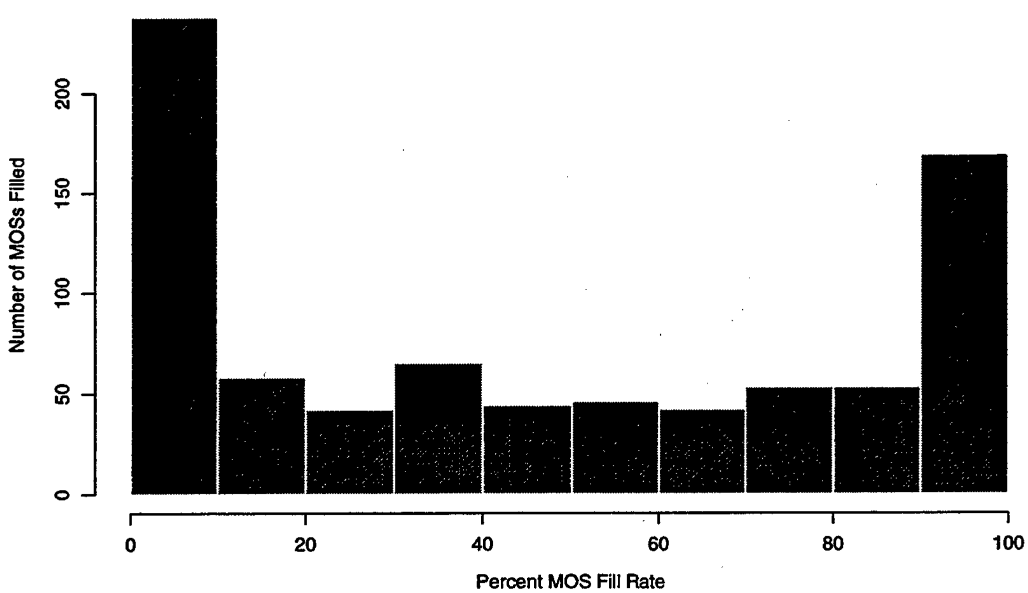
REGION 1 USMCR ACTUAL MOS FILL RATE



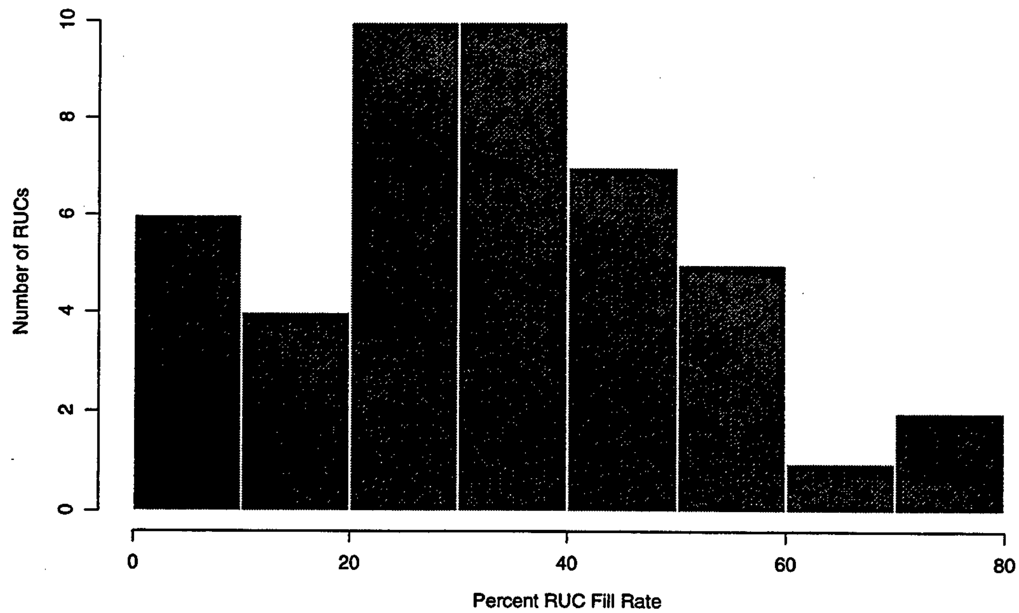
REGION 1 USMCR ACTUAL RUC FILL RATE



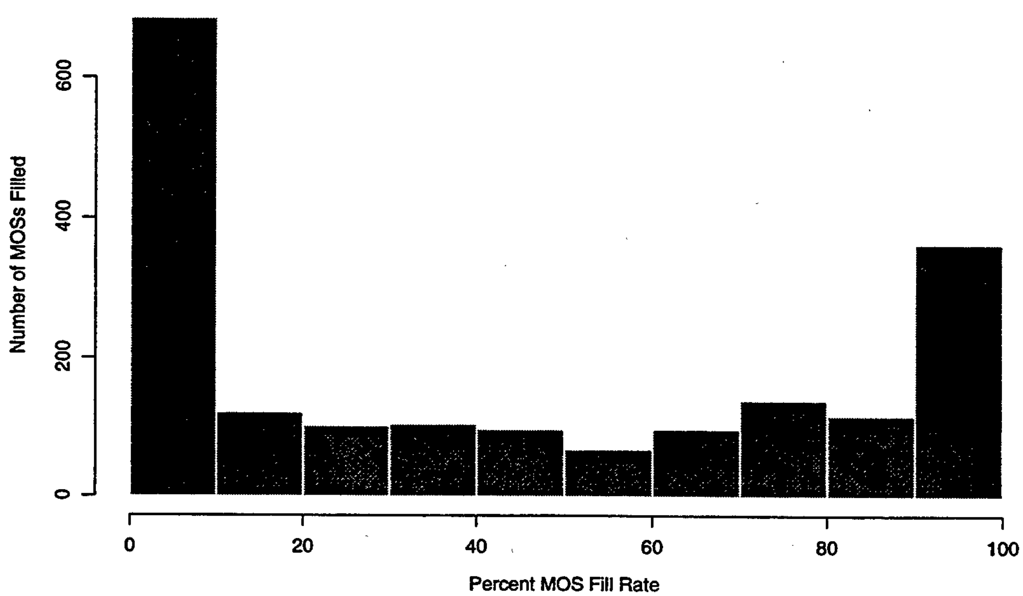
REGION 2 USMCR ACTUAL MOS FILL RATE



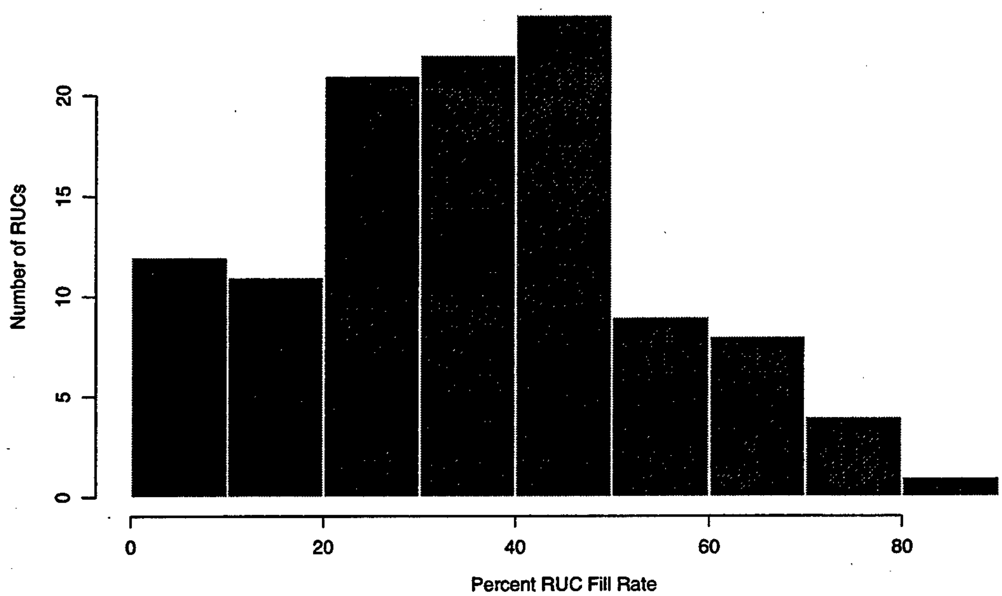
REGION 2 USMCR ACTUAL RUC FILL RATE



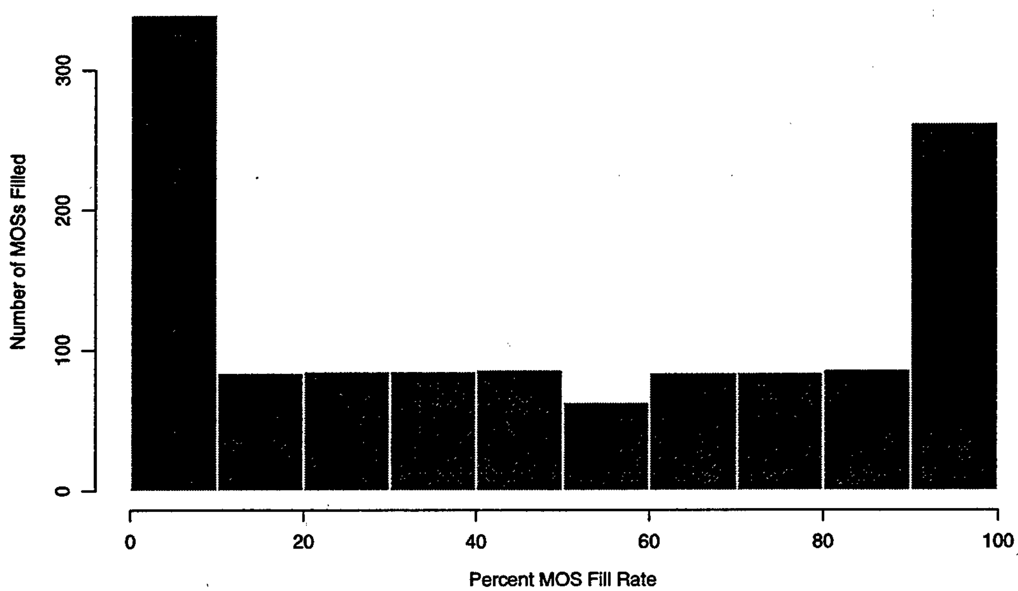
REGION 3 USMCR ACTUAL MOS FILL RATE

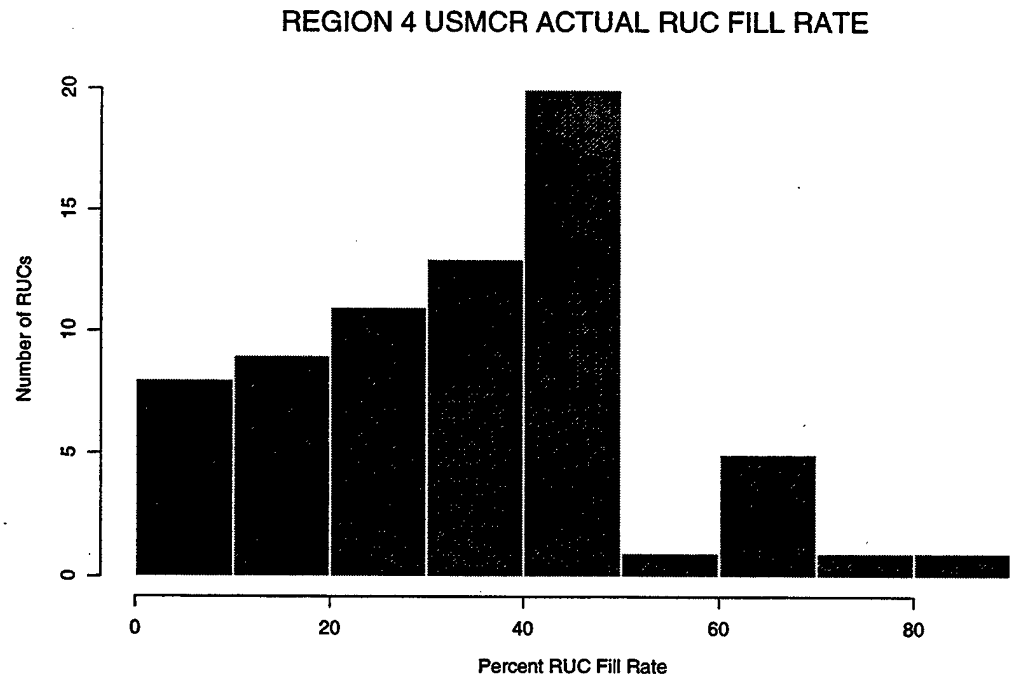


REGION 3 USMCR ACTUAL RUC FILL RATE



REGION 4 USMCR ACTUAL MOS FILL RATE




REGION 4 USMCR ACTUAL RUC FILL RATE
Number of RUCs
0
5
10
15
20
0
20
40
60
80
Percent RUC Fill Rate

APPENDIX D. RUC MOS FILL RATES

RUC	# MOS	# FILL	% FILL	STATE
00048	13	3	23.08	TX
00049	16	0	0.00	GA
00051	16	3	18.75	PA
00053	13	1	7.69	CA
00055	17	9	52.94	MI
00407	11	1	9.09	IL
00408	28	10	35.71	IL
00409	26	8	30.77	CA
00510	20	6	30.00	CA
00512	34	14	41.18	GA
00526	14	7	50.00	PA
00527	38	5	13.16	TX
00540	21	10	47.62	MI
00541	20	9	45.00	WI
00542	23	4	17.39	WA
00983	19	6	31.58	CA
00985	20	10	50.00	MA
01124	37	1	2.70	TX
01129	13	10	76.92	LA
01130	26	6	23.08	TX
01131	37	3	8.11	PA
01134	27	10	37.04	CA
01136	40	7	17.50	TX
01146	29	13	44.83	IL
01148	37	11	29.73	CA
01149	41	7	17.07	CA
01151	25	10	40.00	FL
01180	14	3	21.43	PA
01199	16	2	12.50	MN
01208	22	8	36.36	CA
01209	7	3	42.86	CA
01233	33	7	21.21	NY
01234	35	5	14.29	TX
01236	14	3	21.43	TX
01283	42	11	26.19	CO
01308	15	7	46.67	VA
01309	19	6	31.58	VA
01321	25	13	52.00	MD

01764	24	12	50.00	CA
01767	14	11	78.57	LA
01769	14	5	35.71	CA
01772	17	8	47.06	PA
01773	29	8	27.59	GA
01774	24	9	37.50	VA
04091	54	4	7.41	LA
04147	25	6	24.00	MD
04156	40	8	20.00	GA
04160	5	1	20.00	FL
04169	37	11	29.73	NY
04171	22	8	36.36	CA
04249	5	1	20.00	CO
04714	11	1	9.09	GA
04715	6	2	33.33	GA
04780	28	5	17.86	CA
14003	7	5	71.43	MN
14004	35	1	2.86	OH
14005	19	11	57.89	OH
14007	3	1	33.33	CA
14008	8	2	25.00	AL
14009	1	0	0.00	LA
14011	46	1	2.17	LA
14021	29	14	48.28	CA
14022	10	1	10.00	CA
14023	6	4	66.67	FL
14024	6	1	16.67	VA
14025	6	3	50.00	PA
14026	6	3	50.00	TN
14027	10	5	50.00	DC
14031	42	5	11.90	CA
14032	1	0	0.00	CA
14033	3	2	66.67	MD
14034	16	8	50.00	UT
14035	17	5	29.41	VA
14101	37	11	29.73	CA
14111	33	18	54.55	TX
14114	16	4	25.00	TX
14115	9	4	44.44	TX
14116	6	4	66.67	TX

14118	5	3	60.00	TX
14121	34	17	50.00	CA
14123	15	10	66.67	CA
14124	4	1	25.00	UT
14125	7	2	28.57	CA
14126	13	9	69.23	CA
14127	14	9	64.29	CA
14131	33	11	33.33	LA
14133	10	6	60.00	LA
14134	9	2	22.22	TN
14136	8	4	50.00	AR
14137	11	5	45.45	LA
14138	9	3	33.33	AL
14151	41	8	19.51	KS
14161	33	12	36.36	MI
14163	11	4	36.36	MI
14165	10	5	50.00	MI
14167	17	9	52.94	OH
14168	11	4	36.36	MI
14171	33	16	48.48	IL
14173	9	5	55.56	IA
14174	8	3	37.50	WI
14175	9	4	44.44	WI
14176	11	7	63.64	IL
14181	32	15	46.88	MO
14182	12	4	33.33	TN
14183	12	8	66.67	TN
14184	12	1	8.33	IN
14186	16	6	37.50	MO
14201	37	8	21.62	MA
14211	34	8	23.53	MA
14212	9	4	44.44	ME
14214	9	7	77.78	CT
14216	8	4	50.00	NY
14217	8	3	37.50	MA
14218	9	6	66.67	NH
14221	34	11	32.35	NY
14224	7	3	42.86	NY
14225	7	4	57.14	DE
14226	7	5	71.43	PA

14227	8	2	25.00	NY
14231	33	12	36.36	OH
14234	8	2	25.00	OH
14235	13	5	38.46	PA
14236	8	6	75.00	OH
14237	12	6	50.00	WV
14301	47	7	14.89	TX
14313	18	9	50.00	WA
14314	18	9	50.00	CA
14321	37	9	24.32	TX
14331	38	11	28.95	PA
14333	18	8	44.44	NJ
14334	17	8	47.06	VA
14335	17	7	41.18	PA
14341	37	16	43.24	AL
14344	16	7	43.75	AL
14345	16	3	18.75	TN
14352	16	6	37.50	TX
14354	16	6	37.50	CO
14401	27	10	37.04	MD
14403	12	6	50.00	WV
14404	12	8	66.67	VA
14405	12	4	33.33	VA
14406	11	3	27.27	TN
14407	19	4	21.05	MD
14421	6	1	16.67	WA
14551	34	12	35.29	WA
14552	12	5	41.67	WA
14554	18	8	44.44	SC
14601	38	10	26.32	CA
14604	18	5	27.78	MS
14613	18	4	22.22	IA
14614	18	6	33.33	IL
14616	18	10	55.56	OK
14633	16	7	43.75	AL
14641	37	7	18.92	CA
14643	16	7	43.75	CA
14652	17	8	47.06	TX
14653	3	0	0.00	OK
14654	17	11	64.71	FL

14661	8	2	25.00	PA
14662	12	5	41.67	PA
14663	8	3	37.50	DC
14664	8	4	50.00	GA
14701	30	13	43.33	TX
14702	4	0	0.00	TX
14703	8	3	37.50	MT
14704	16	8	50.00	NV
14705	8	3	37.50	NM
14706	4	1	25.00	TX
14707	8	4	50.00	AK
20094	10	1	10.00	CA
20095	10	4	40.00	NC
20096	14	4	28.57	NC
20097	14	0	0.00	CA
20124	41	6	14.63	CA
20161	39	9	23.08	NC
20192	19	9	47.37	CA
20193	19	10	52.63	DC
21337	16	0	0.00	MI
21401	31	12	38.71	NY
21403	16	9	56.25	KY
21404	24	7	29.17	NY
21405	16	6	37.50	FL
21441	39	9	23.08	CA
21442	9	7	77.78	CA
21443	17	6	35.29	WA
21444	17	8	47.06	ID
21626	26	17	65.38	CA
21627	13	10	76.92	FL
21628	26	10	38.46	FL
21681	28	4	14.29	NY
21683	11	3	27.27	NY
21684	30	0	0.00	NY
21685	16	3	18.75	NY
21831	41	13	31.71	FL
21832	7	4	57.14	MS
21833	16	10	62.50	FL
21834	16	8	50.00	VA
21835	6	5	83.33	TX

22321	34	12	35.29	OR
22322	17	5	29.41	OR
22324	18	4	22.22	MI
22325	17	4	23.53	IN
22327	15	8	53.33	AZ
22328	9	1	11.11	OR
23973	14	0	0.00	CA
23974	16	4	25.00	CA
24246	12	3	25.00	PA
28111	30	13	43.33	NJ
28114	14	6	42.86	CT
28115	15	9	60.00	RI
28353	17	5	29.41	HI
29052	30	7	23.33	GA
29053	28	11	39.29	NC
29054	23	11	47.83	CA
29057	20	4	20.00	GA
29058	12	6	50.00	NC
29059	12	7	58.33	PR
29061	29	7	24.14	VA
29062	17	11	64.71	SC
29063	14	6	42.86	AZ
29064	5	1	20.00	DC
29065	8	2	25.00	NC
29066	4	2	50.00	VA
29067	2	1	50.00	CA
29071	30	13	43.33	NC
29073	19	5	26.32	KS
29074	18	8	44.44	NE
29075	9	4	44.44	CA
29076	30	7	23.33	IL
29077	14	4	28.57	NC
29078	16	4	25.00	IN
29084	40	1	2.50	LA
29085	9	4	44.44	GA
70694	17	9	52.94	MA
71007	23	5	21.74	PA
71701	13	5	38.46	DE
71703	5	1	20.00	PA
71706	5	1	20.00	PA

71776	13	3	23.08	KY
71778	10	2	20.00	OH
73010	22	4	18.18	AL
73757	10	4	40.00	SC
74016	9	5	55.56	LA
74215	9	2	22.22	MA
74489	16	6	37.50	TX
74746	18	7	38.89	TX
74860	11	4	36.36	TX
75188	5	2	40.00	KS
75240	35	9	25.71	IN
75301	16	6	37.50	IL
75724	10	1	10.00	KS
75731	24	3	12.50	IN
77000	13	6	46.15	CA
77004	5	4	80.00	GA
77006	4	1	25.00	KS
77030	13	4	30.77	TX
77060	7	2	28.57	GA
77084	11	1	9.09	VA
77142	6	5	83.33	NV
77749	13	9	69.23	CA
77775	16	7	43.75	OR
96210	2	0	0.00	DC
96211	2	0	0.00	DC
96213	2	1	50.00	CA
96215	2	0	0.00	MA
96217	2	0	0.00	IL
96220	2	0	0.00	CA
96222	2	0	0.00	CA
96224	2	1	50.00	FL
96226	2	1	50.00	NY

APPENDIX E. SAMPLE MOS RUC FILL RATES

Ruc	MOS	Shortage	State	Ruc	MOS	Shortage	State
00048	0151	20.83	TX	14163	0151	72.92	MI
00053	0151	0.00	CA	14165	0151	79.17	MI
00055	0151	89.58	MI	14167	0151	100.00	OH
00408	0151	77.08	IL	14168	0151	100.00	MI
00512	0151	97.92	GA	14171	0151	95.83	IL
00527	0151	14.58	TX	14173	0151	37.50	IA
00540	0151	100.00	MI	14175	0151	4.17	WI
00985	0151	100.00	MA	14176	0151	100.00	IL
01129	0151	100.00	LA	14181	0151	100.00	MO
01134	0151	97.92	CA	14182	0151	64.58	TN
01136	0151	72.92	TX	14183	0151	83.33	TN
01146	0151	100.00	IL	14184	0151	2.08	IN
01148	0151	100.00	CA	14186	0151	100.00	MO
01149	0151	75.00	CA	14201	0151	22.92	MA
01151	0151	70.83	FL	14211	0151	75.00	MA
01208	0151	91.67	CA	14212	0151	50.00	ME
01209	0151	70.83	CA	14214	0151	79.17	CT
01233	0151	100.00	NY	14216	0151	85.42	NY
01234	0151	75.00	TX	14218	0151	81.25	NH
01283	0151	100.00	CO	14221	0151	35.42	NY
01321	0151	100.00	MD	14224	0151	77.08	NY
04091	0151	0.00	LA	14225	0151	100.00	DE
04147	0151	6.25	MD	14226	0151	91.67	PA
04156	0151	70.83	GA	14231	0151	95.83	OH
04160	0151	16.67	FL	14234	0151	100.00	OH
04169	0151	100.00	NY	14235	0151	81.25	PA
04249	0151	100.00	CO	14236	0151	95.83	OH
14003	0151	85.42	MN	14237	0151	87.50	WV
14004	0151	100.00	OH	14301	0151	100.00	TX
14005	0151	100.00	OH	14314	0151	100.00	CA
14008	0151	43.75	AL	14321	0151	66.67	TX
14011	0151	29.17	LA	14331	0151	60.42	PA
14021	0151	72.92	CA	14333	0151	41.67	NJ
14031	0151	60.42	CA	14334	0151	72.92	VA
14033	0151	89.58	MD	14335	0151	31.25	PA
14034	0151	87.50	UT	14341	0151	85.42	AL
14035	0151	68.75	VA	14401	0151	87.50	MD
14101	0151	66.67	CA	14403	0151	14.58	WV

14111	0151	100.00	TX	14404	0151	97.92	VA
14115	0151	100.00	TX	14551	0151	37.50	WA
14121	0151	100.00	CA	14552	0151	100.00	WA
14123	0151	83.33	CA	14554	0151	100.00	SC
14126	0151	95.83	CA	14601	0151	81.25	CA
14127	0151	100.00	CA	14604	0151	52.08	MS
14131	0151	89.58	LA	14613	0151	91.67	IA
14133	0151	85.42	LA	14614	0151	100.00	IL
14151	0151	14.58	KS	14641	0151	100.00	CA
14161	0151	35.42	MI	14652	0151	100.00	TX
14654	0151	77.08	FL	29071	0151	95.83	NC
14662	0151	100.00	PA	29073	0151	100.00	KS
14663	0151	79.17	DC	29075	0151	100.00	CA
14701	0151	100.00	TX	29076	0151	60.42	IL
14703	0151	62.50	MT	29078	0151	81.25	IN
14704	0151	68.75	NV	29084	0151	91.67	LA
14705	0151	64.58	NM	29085	0151	68.75	GA
14707	0151	81.25	AK	70694	0151	100.00	MA
20094	0151	14.58	CA	71007	0151	100.00	PA
20095	0151	0.00	NC	71776	0151	64.58	KY
20096	0151	64.58	NC	71778	0151	18.75	OH
20097	0151	0.00	CA	73010	0151	29.17	AL
20124	0151	10.42	CA	73757	0151	68.75	SC
20161	0151	27.08	NC	74016	0151	100.00	LA
20192	0151	100.00	CA	74215	0151	81.25	MA
20193	0151	95.83	DC	74489	0151	100.00	TX
21337	0151	0.00	MI	74746	0151	100.00	TX
21401	0151	100.00	NY	74860	0151	0.00	TX
21403	0151	39.58	KY	75240	0151	100.00	IN
21404	0151	37.50	NY	75301	0151	91.67	IL
21405	0151	52.08	FL	75731	0151	58.33	IN
21441	0151	100.00	CA	77000	0151	31.25	CA
21443	0151	83.33	WA	77004	0151	100.00	GA
21444	0151	97.92	ID	77006	0151	93.75	KS
21626	0151	93.75	CA	77030	0151	75.00	TX
21627	0151	87.50	FL	77060	0151	87.50	GA
21628	0151	62.50	FL	77084	0151	79.17	VA
21681	0151	50.00	NY	77142	0151	85.42	NV
21684	0151	0.00	NY	77749	0151	100.00	CA
21685	0151	85.42	NY	96210	0151	43.75	DC

21831	0151	0.00	FL
22321	0151	100.00	OR
22327	0151	100.00	AZ
22328	0151	39.58	OR
24246	0151	31.25	PA
28111	0151	97.92	NJ
28114	0151	100.00	CT
28115	0151	97.92	RI
28353	0151	43.75	HI
29052	0151	12.50	GA
29053	0151	81.25	NC
29054	0151	100.00	CA
29058	0151	100.00	NC
29059	0151	56.25	PR
29061	0151	22.92	VA
29062	0151	70.83	SC
29063	0151	54.17	AZ
29065	0151	100.00	NC
29066	0151	33.33	VA
96211	0151	41.67	DC
96213	0151	50.00	CA
00049	0151	0.00	GA
00051	0151	25.00	PA

Ruc	MOS	Shortage	State	Ruc	MOS	Shortage	State
00048	0231	22.92	TX	14151	0231	83.33	KS
00053	0231	66.67	CA	14161	0231	14.58	MI
00055	0231	25.00	MI	14171	0231	2.08	IL
01124	0231	0.00	TX	14181	0231	12.50	MO
01130	0231	37.50	TX	14201	0231	54.17	MA
01131	0231	0.00	PA	14211	0231	0.00	MA
01134	0231	25.00	CA	14221	0231	37.50	NY
01151	0231	89.58	FL	14231	0231	25.00	OH
01208	0231	0.00	CA	14301	0231	18.75	TX
01233	0231	52.08	NY	14321	0231	16.67	TX
01234	0231	0.00	TX	14331	0231	91.67	PA
01283	0231	0.00	CO	14341	0231	12.50	AL
01309	0231	0.00	VA	14401	0231	0.00	MD
01321	0231	83.33	MD	14601	0231	16.67	CA
01764	0231	85.42	CA	14641	0231	4.17	CA
01767	0231	81.25	LA	14701	0231	29.17	TX
01772	0231	75.00	PA	14704	0231	100.00	NV
01773	0231	0.00	GA	20124	0231	18.75	CA
01774	0231	2.08	VA	20161	0231	62.50	NC
04091	0231	41.67	LA	20192	0231	0.00	CA
04147	0231	0.00	MD	20193	0231	100.00	DC
04171	0231	50.00	CA	21401	0231	0.00	NY
04714	0231	4.17	GA	21441	0231	60.42	CA
04780	0231	0.00	CA	21831	0231	100.00	FL
14008	0231	22.92	AL	22321	0231	77.08	OR
14011	0231	4.17	LA	28353	0231	8.33	HI
14031	0231	0.00	CA	29052	0231	0.00	GA
14101	0231	83.33	CA	29084	0231	0.00	LA
14111	0231	4.17	TX	73010	0231	14.58	AL
14121	0231	0.00	CA	00049	0231	0.00	GA
14131	0231	72.92	LA	00051	0231	50.00	PA

Ruc	MOS	Shortage	State
14114	0331	45.83	TX
14115	0331	54.17	TX
14116	0331	35.42	TX
14125	0331	33.33	CA
14126	0331	79.17	CA
14127	0331	70.83	CA
14133	0331	72.92	LA
14134	0331	45.83	TN
14136	0331	22.92	AR
14137	0331	91.67	LA
14138	0331	50.00	AL
14163	0331	10.42	MI
14165	0331	41.67	MI
14167	0331	77.08	OH
14168	0331	2.08	MI
14173	0331	0.00	IA
14174	0331	79.17	WI
14175	0331	22.92	WI
14176	0331	97.92	IL
14182	0331	0.00	TN
14183	0331	35.42	TN
14184	0331	0.00	IN
14186	0331	100.00	MO
14212	0331	33.33	ME
14214	0331	75.00	CT
14216	0331	68.75	NY
14217	0331	100.00	MA
14218	0331	35.42	NH
14224	0331	0.00	NY
14225	0331	95.83	DE
14226	0331	50.00	PA
14227	0331	100.00	NY
14234	0331	93.75	OH
14236	0331	64.58	OH
14237	0331	100.00	WV
77142	0331	79.17	NV

Ruc	MOS	Shortage	State	Ruc	MOS	Shortage	State
00048	3051	97.92	TX	14181	3051	100.00	MO
00053	3051	100.00	CA	14182	3051	79.17	TN
00407	3051	54.17	IL	14186	3051	25.00	MO
00510	3051	89.58	CA	14201	3051	12.50	MA
00512	3051	4.17	GA	14211	3051	0.00	MA
00526	3051	100.00	PA	14221	3051	87.50	NY
00527	3051	16.67	TX	14231	3051	66.67	OH
00540	3051	100.00	MI	14235	3051	87.50	PA
00541	3051	87.50	WI	14301	3051	12.50	TX
00542	3051	79.17	WA	14321	3051	43.75	TX
00983	3051	64.58	CA	14331	3051	62.50	PA
00985	3051	100.00	MA	14341	3051	72.92	AL
01129	3051	47.92	LA	14401	3051	89.58	MD
01146	3051	93.75	IL	14407	3051	47.92	MD
01149	3051	10.42	CA	14421	3051	22.92	WA
01180	3051	60.42	PA	14551	3051	100.00	WA
01199	3051	85.00	MN	14554	3051	97.92	SC
01208	3051	77.08	CA	14601	3051	22.92	CA
01283	3051	14.58	CO	14641	3051	100.00	CA
01309	3051	77.08	VA	14652	3051	14.58	TX
04091	3051	75.00	LA	14654	3051	100.00	FL
04171	3051	88.24	CA	14662	3051	100.00	PA
04714	3051	47.92	GA	14663	3051	10.42	DC
14005	3051	100.00	OH	14664	3051	100.00	GA
14011	3051	12.50	LA	14701	3051	100.00	TX
14021	3051	79.17	CA	14704	3051	39.58	NV
14031	3051	0.00	CA	20096	3051	14.58	NC
14035	3051	66.67	VA	20097	3051	0.00	CA
14101	3051	77.08	CA	20124	3051	85.42	CA
14111	3051	100.00	TX	20192	3051	100.00	CA
14114	3051	6.25	TX	20193	3051	39.58	DC
14121	3051	79.17	CA	21337	3051	31.25	MI
14123	3051	100.00	CA	21401	3051	77.08	NY
14127	3051	72.92	CA	21403	3051	100.00	KY
14131	3051	93.75	LA	21404	3051	75.00	NY
14151	3051	83.33	KS	21405	3051	100.00	FL
14161	3051	22.92	MI	21441	3051	2.08	CA
14167	3051	100.00	OH	21442	3051	39.58	CA
14171	3051	95.83	IL	21443	3051	100.00	WA

21444	3051	100.00	ID	29063	3051	81.25	AZ
21626	3051	81.25	CA	29064	3051	0.00	DC
21627	3051	70.83	FL	29065	3051	58.33	NC
21628	3051	100.00	FL	29066	3051	85.42	VA
21681	3051	68.75	NY	29067	3051	100.00	CA
21683	3051	64.58	NY	29071	3051	100.00	NC
21685	3051	68.75	NY	29073	3051	100.00	KS
21831	3051	83.33	FL	29074	3051	100.00	NE
21833	3051	100.00	FL	71701	3051	87.50	DE
21834	3051	70.83	VA	71776	3051	97.92	KY
22321	3051	0.00	OR	73010	3051	50.00	AL
22322	3051	64.58	OR	73757	3051	47.92	SC
22324	3051	75.00	MI	74489	3051	70.83	TX
22325	3051	100.00	IN	74746	3051	91.67	TX
22327	3051	77.08	AZ	74860	3051	100.00	TX
23974	3051	50.00	CA	75240	3051	33.33	IN
28111	3051	85.42	NJ	75301	3051	58.33	IL
28114	3051	100.00	CT	75724	3051	0.00	KS
28115	3051	100.00	RI	77000	3051	0.00	CA
28353	3051	100.00	HI	77004	3051	70.83	GA
29052	3051	27.08	GA	77006	3051	16.67	KS
29053	3051	100.00	NC	77030	3051	85.42	TX
29054	3051	10.42	CA	77749	3051	45.83	CA
29057	3051	45.83	GA	77775	3051	97.92	OR
29058	3051	58.33	NC	00049	3051	0.00	GA
29059	3051	43.75	PR	00051	3051	0.00	PA
29061	3051	0.00	VA	01236	3051	0.00	TX
29062	3051	64.58	SC				

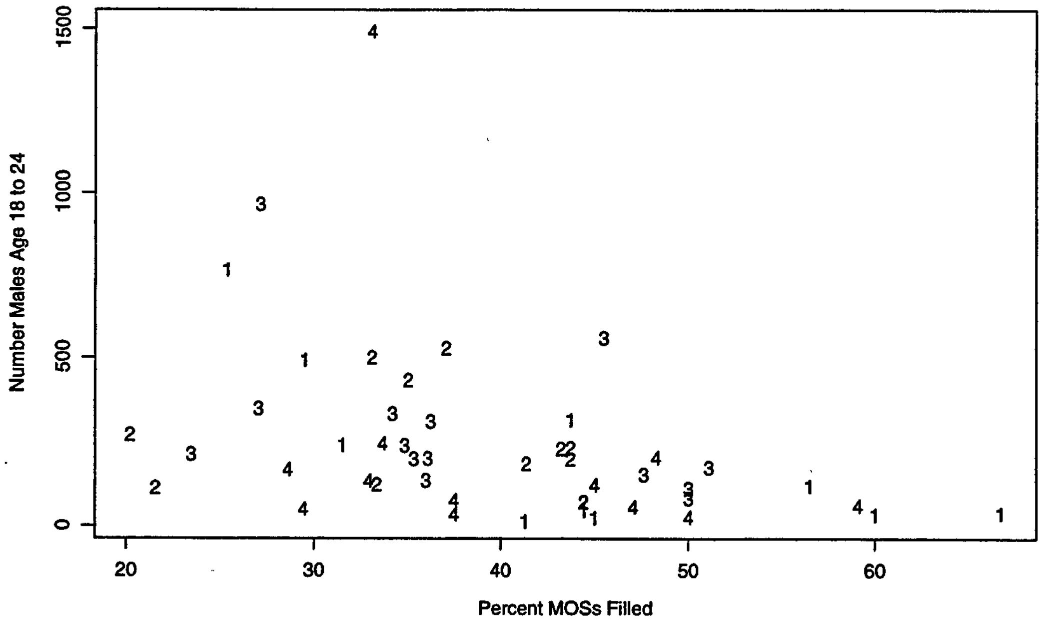
APPENDIX F. STATE MOS FILL RATES

STATE	# MOS	# FILL	% FILL	YATSREG
AK	8.00	4.00	50.00	4
AL	108.00	39.00	36.11	3
AR	8.00	4.00	50.00	3
AZ	29.00	14.00	48.28	4
CA	868.00	287.00	33.06	4
CO	63.00	18.00	28.57	4
CT	23.00	13.00	56.52	1
DC	46.00	19.00	41.30	1
DE	20.00	9.00	45.00	1
FL	167.00	76.00	45.51	3
GA	215.00	58.00	26.98	3
HI	17.00	5.00	29.41	4
IA	27.00	9.00	33.33	2
ID	17.00	8.00	47.06	4
IL	178.00	66.00	37.08	2
IN	104.00	21.00	20.19	2
KS	79.00	17.00	21.52	2
KY	29.00	12.00	41.38	2
LA	231.00	54.00	23.38	3
MA	127.00	40.00	31.50	1
MD	99.00	35.00	35.35	3
ME	9.00	4.00	44.44	1
MI	137.00	48.00	35.04	2
MN	16.00	7.00	43.75	2
MO	48.00	21.00	43.75	2
MS	25.00	9.00	36.00	3
MT	8.00	3.00	37.50	4
NC	155.00	53.00	34.19	3
NE	18.00	8.00	44.44	2
NH	9.00	6.00	66.67	1
NJ	48.00	21.00	43.75	1
NM	8.00	3.00	37.50	4
NV	22.00	13.00	59.09	4
NY	269.00	68.00	25.28	1
OH	130.00	43.00	33.08	2
OK	21.00	10.00	47.62	3
OR	76.00	25.00	32.89	4
PA	244.00	72.00	29.51	1

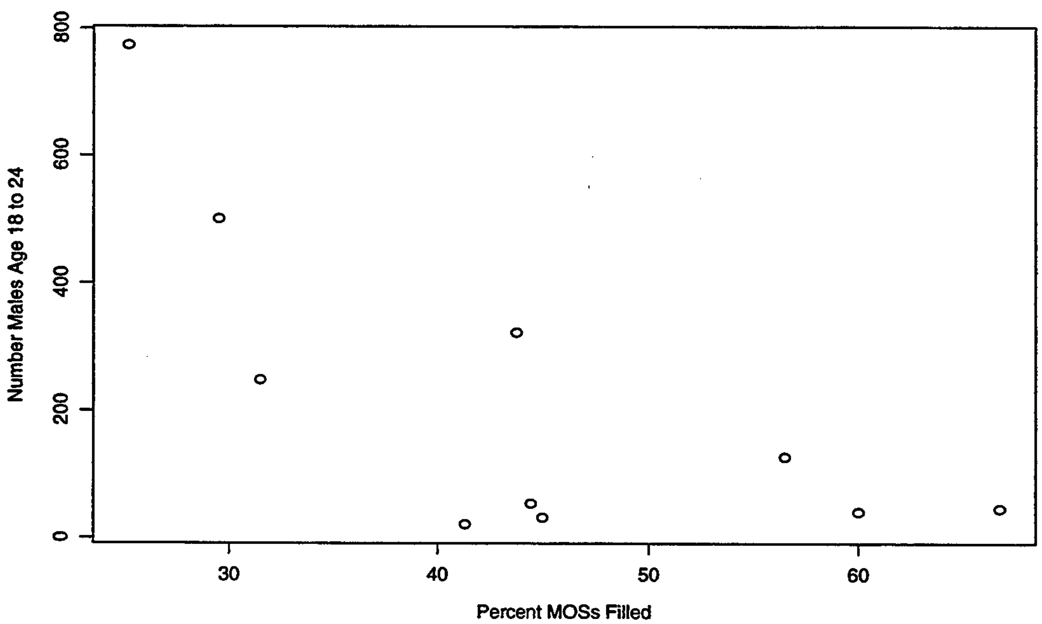
RI	15.00	9.00	60.00	1
SC	45.00	23.00	51.11	3
TN	66.00	23.00	34.85	3
TX	491.00	133.00	27.09	3
UT	20.00	9.00	45.00	4
VA	182.00	66.00	36.26	3
WA	110.00	37.00	33.64	4
WI	37.00	16.00	43.24	2
WV	24.00	12.00	50.00	3

APPENDIX G. DEMOGRAPHIC FACTOR SCATTER PLOTS

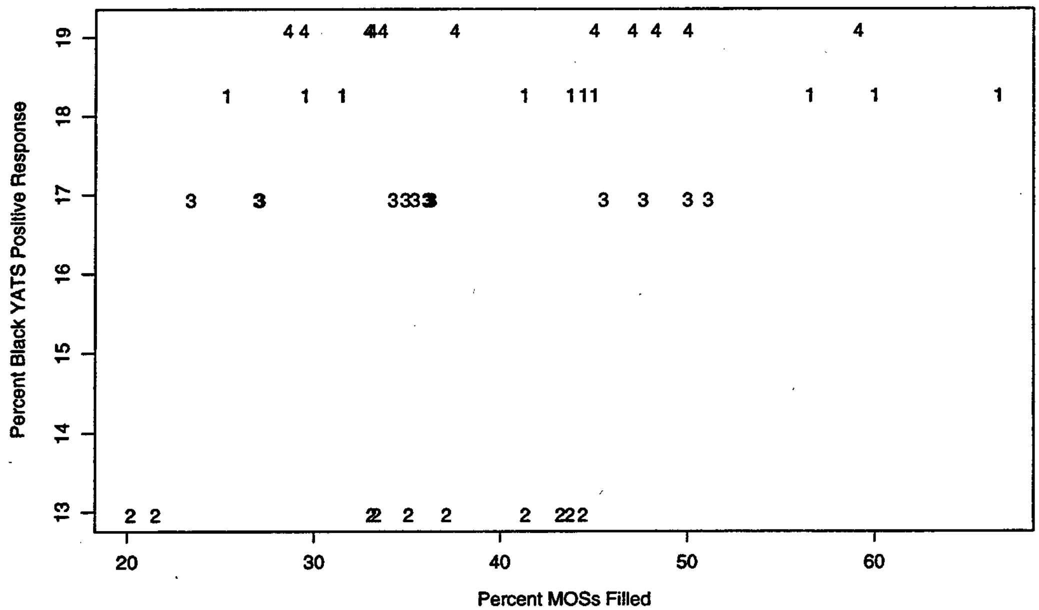
PERCENT MOSs FILLED vs NUMBER MALES AGE 18 TO 24



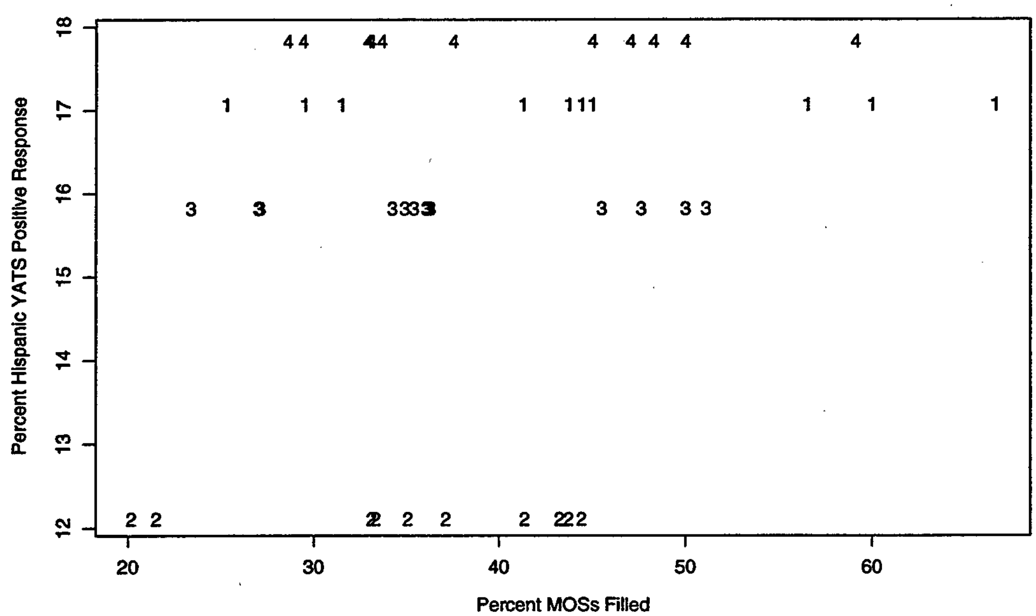
REGION 1 PERCENT MOSs FILLED vs NUMBER MALES AGE 18 TO 24

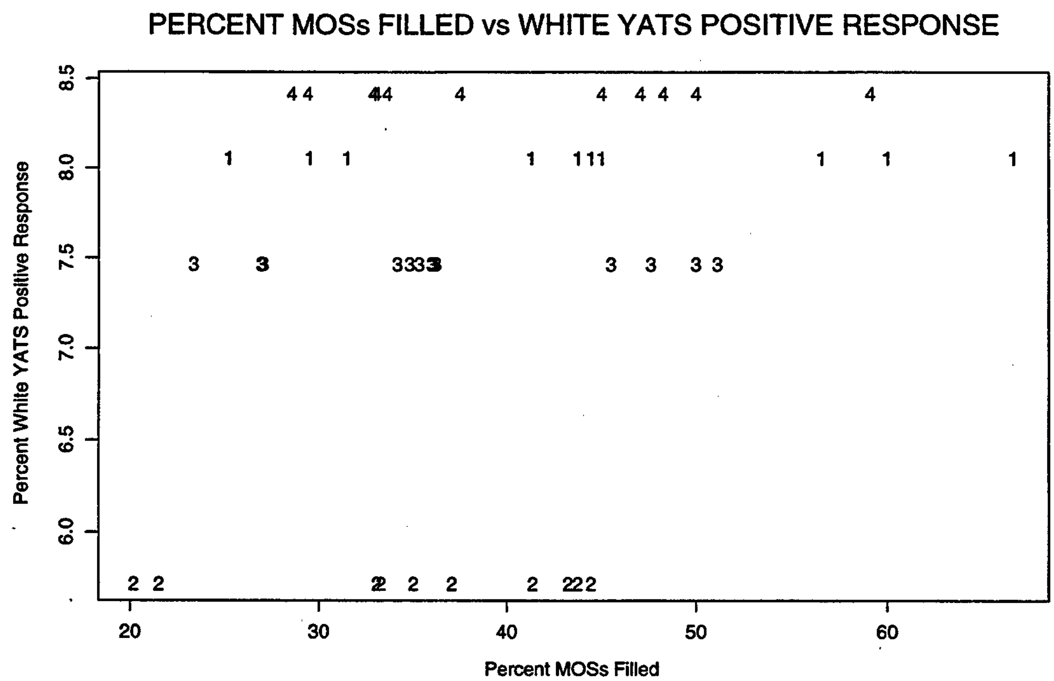


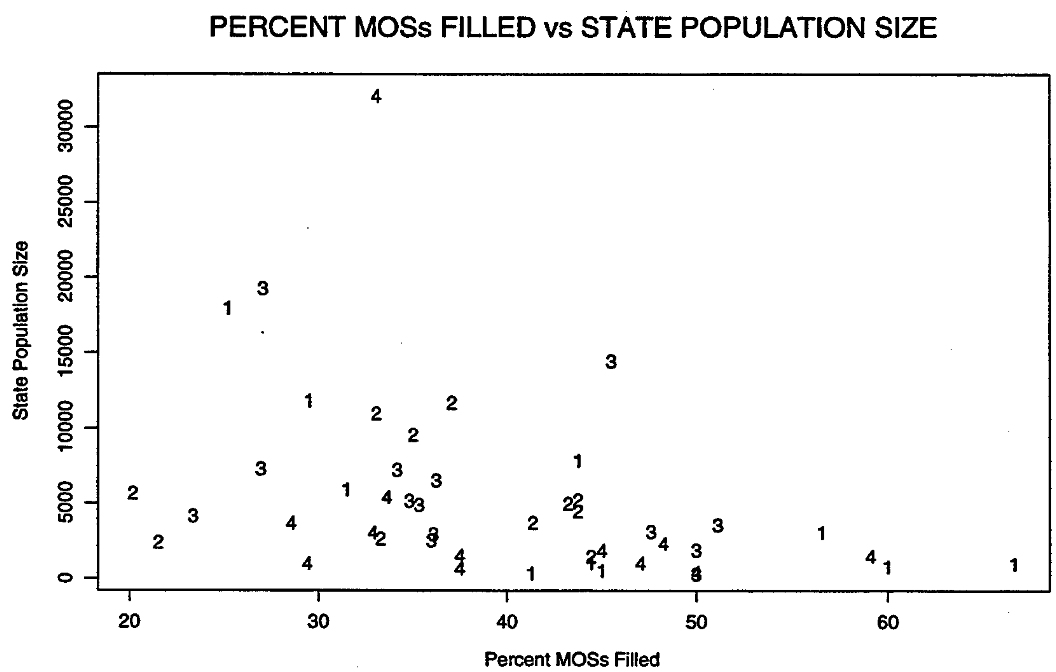
PERCENT MOSs FILLED vs BLACK YATS POSITIVE RESPONSE



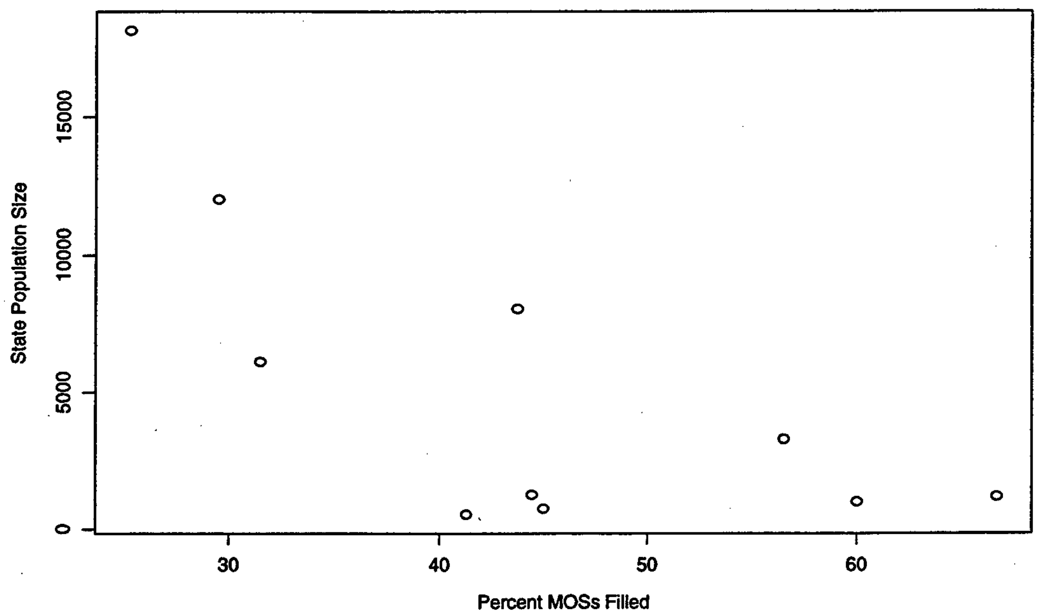
PERCENT MOSs FILLED vs HISPANIC YATS POSITIVE RESPONSE




PERCENT MOSs FILLED vs WHITE YATS POSITIVE RESPONSE
Percent White YATS Positive Response
Percent MOSs Filled


PERCENT MOSs FILLED vs STATE POPULATION SIZE
State Population Size
Percent MOSs Filled

REGION 1 PERCENT MOSs FILLED vs STATE POPULATION SIZE



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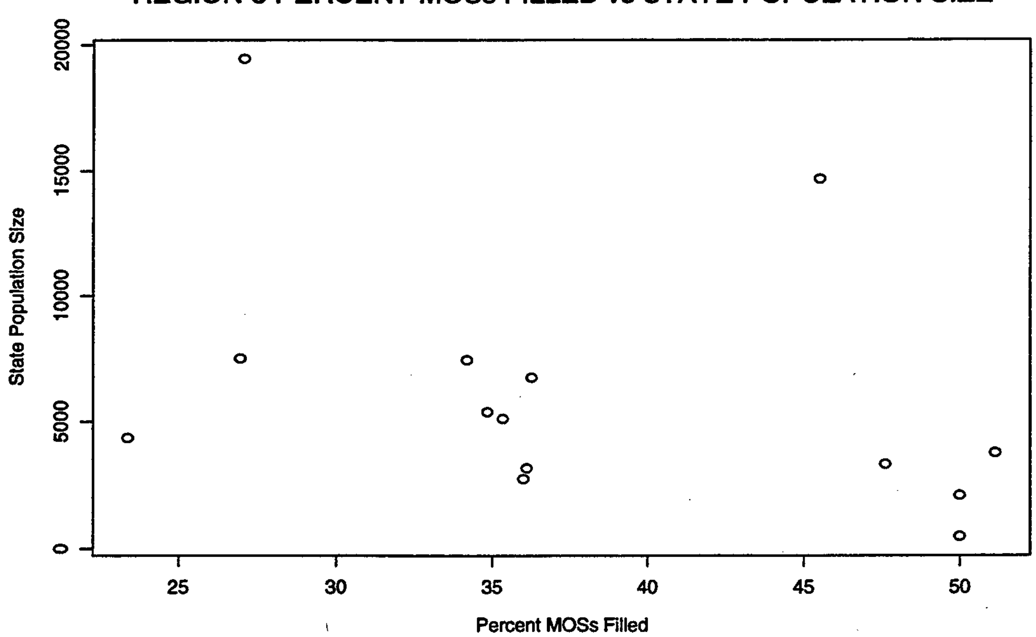

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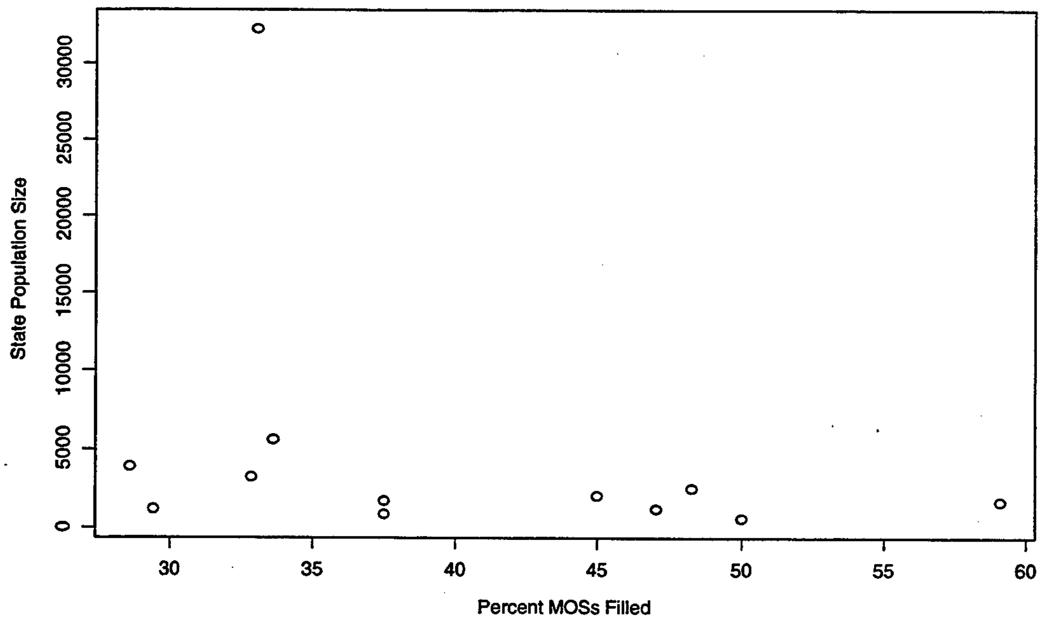
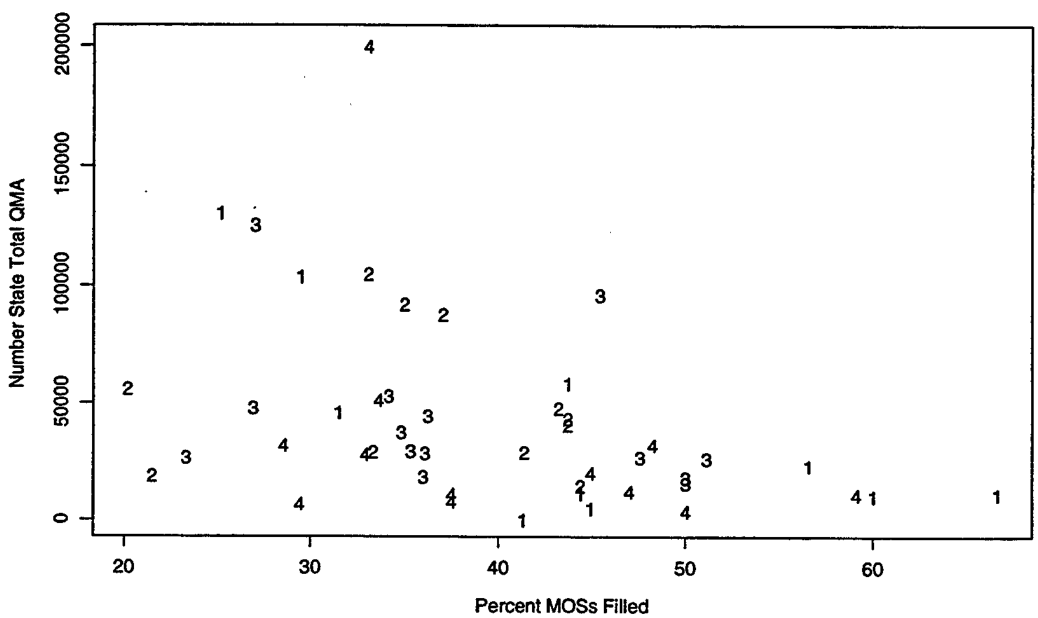
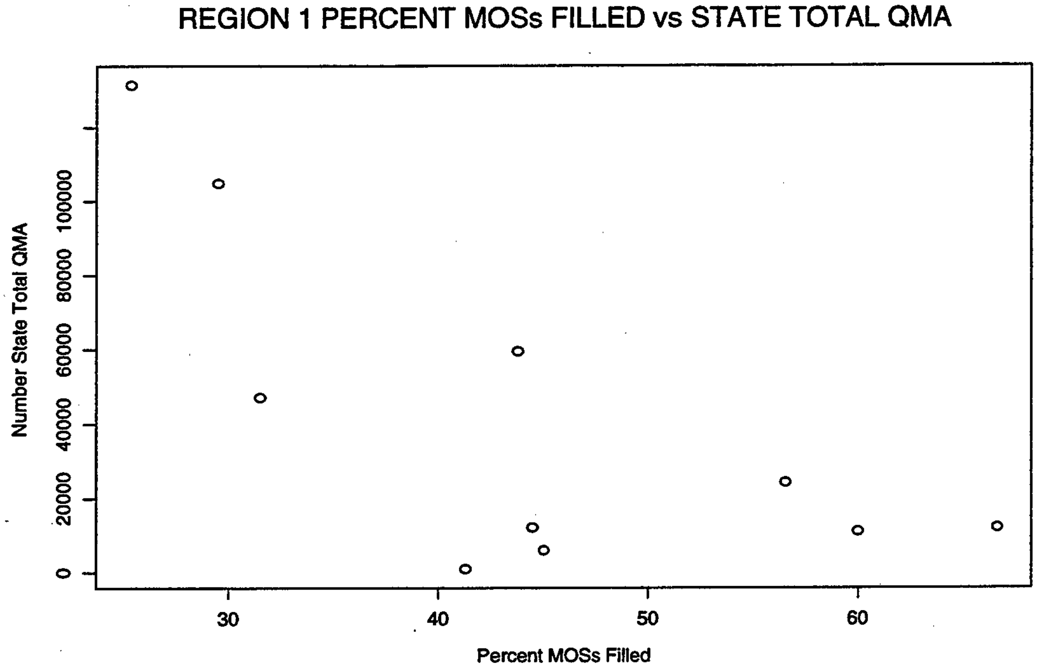
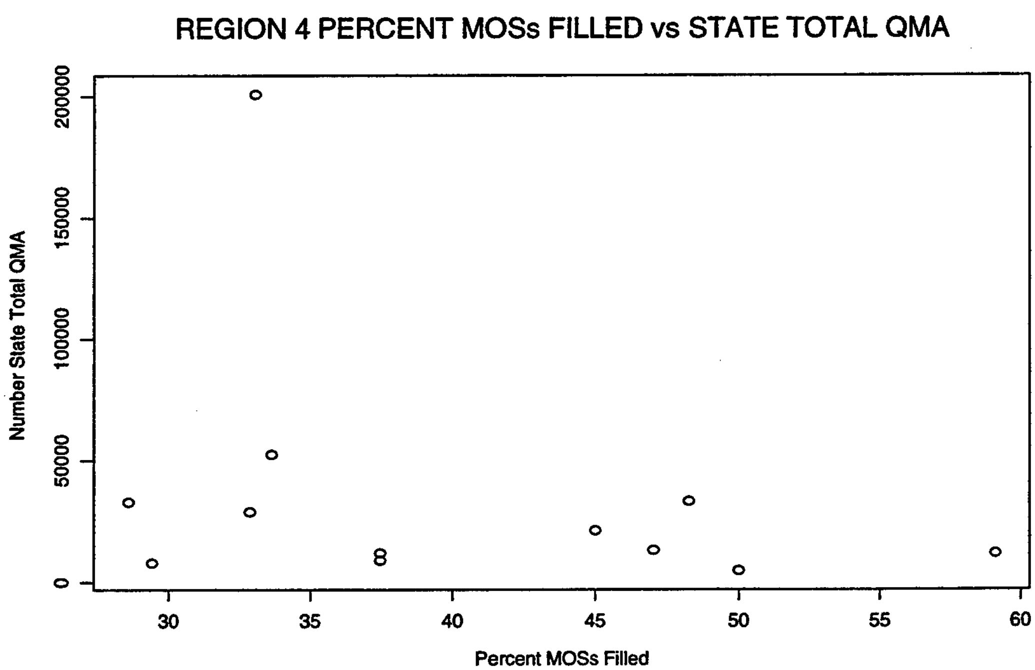


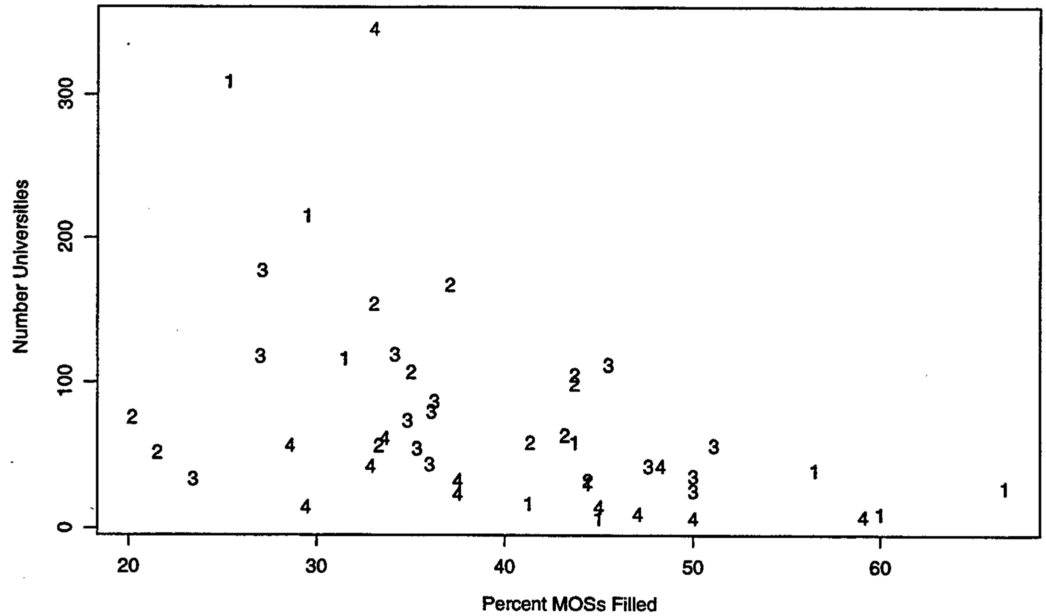
PERCENT MOSs FILLED vs STATE TOTAL QMA



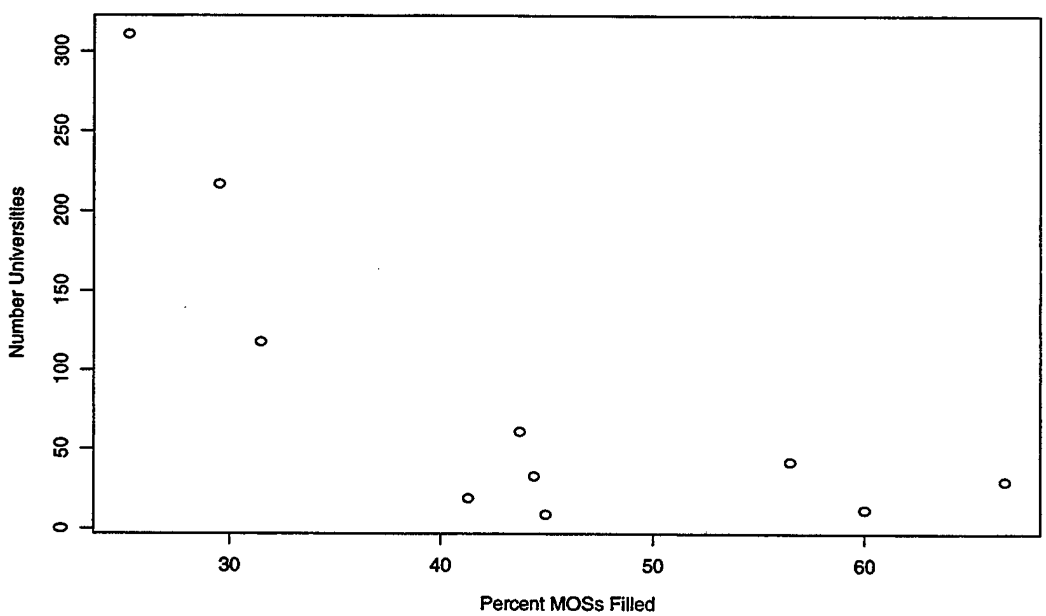

REGION 1 PERCENT MOSs FILLED vs STATE TOTAL QMA
Number State Total QMA
0
20000
40000
60000
80000
100000
30
40
50
60
Percent MOSs Filled


REGION 4 PERCENT MOSs FILLED vs STATE TOTAL QMA
Number State Total QMA
0
50000
100000
150000
200000
30
35
40
45
50
55
60
Percent MOSs Filled

PERCENT MOSs FILLED vs NUMBER UNIVERSITIES



REGION 1 PERCENT MOSs FILLED vs NUMBER UNIVERSITIES



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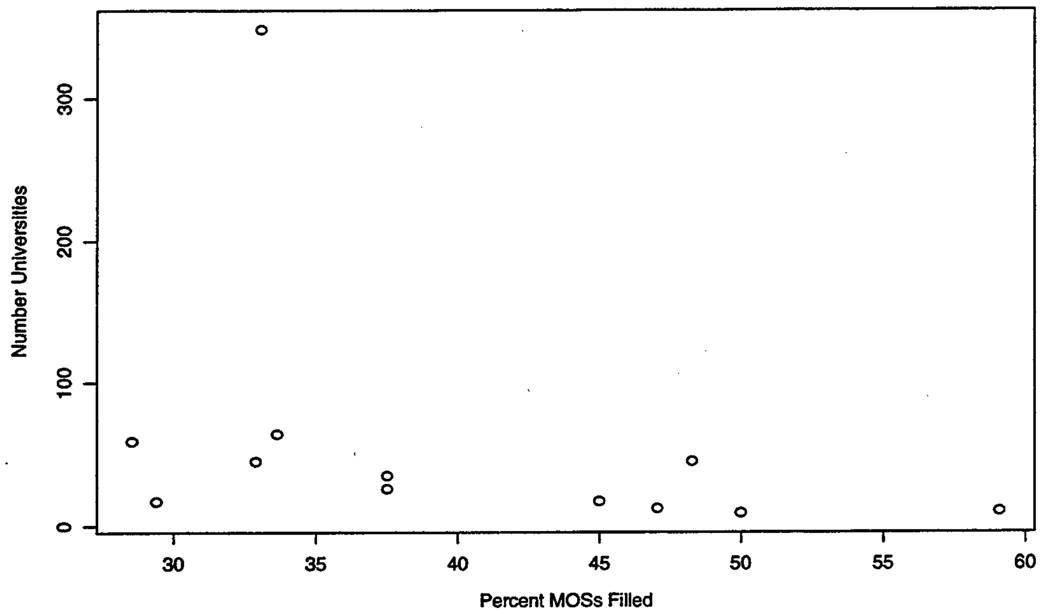
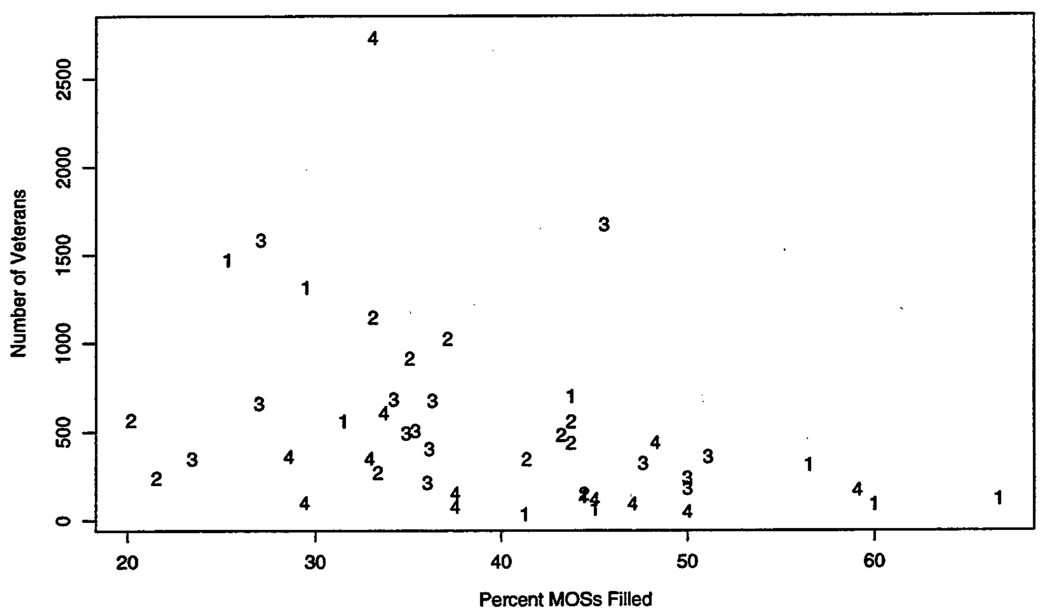


PERCENT MOSs FILLED vs STATE VETERAN POPULATION



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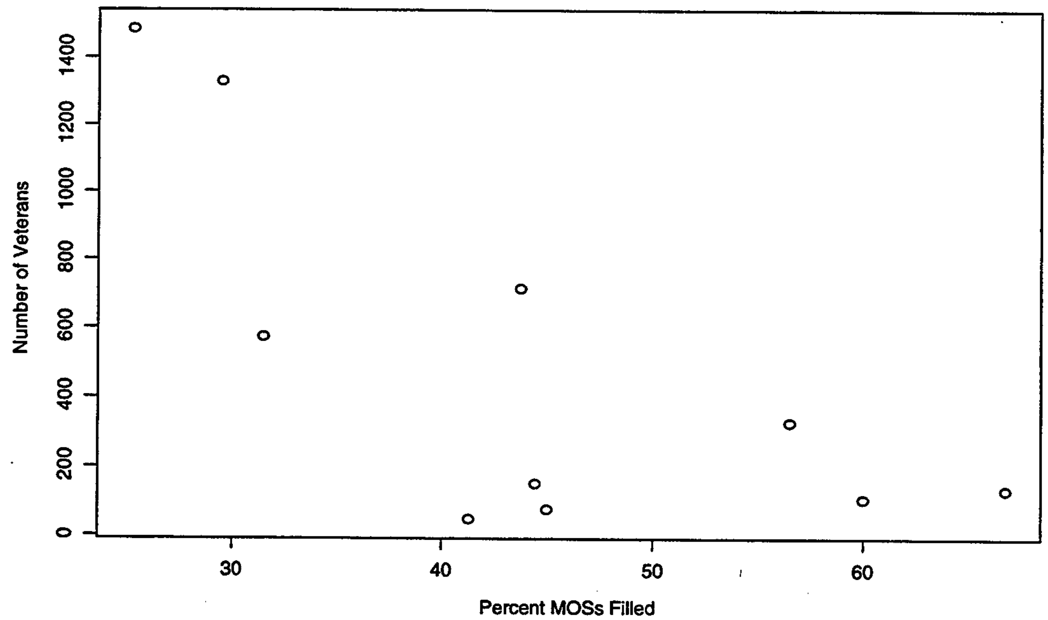

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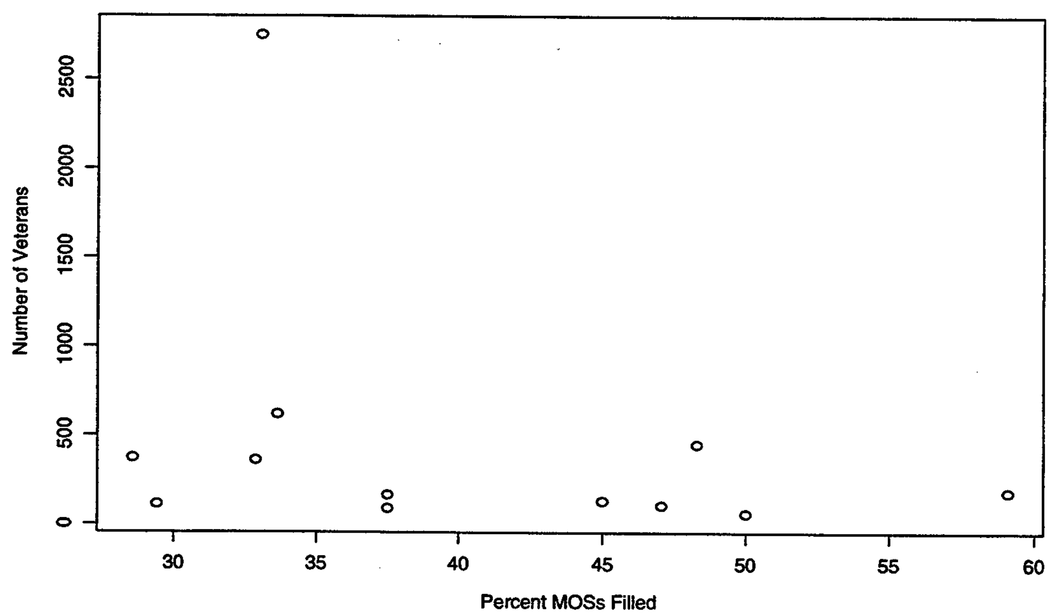
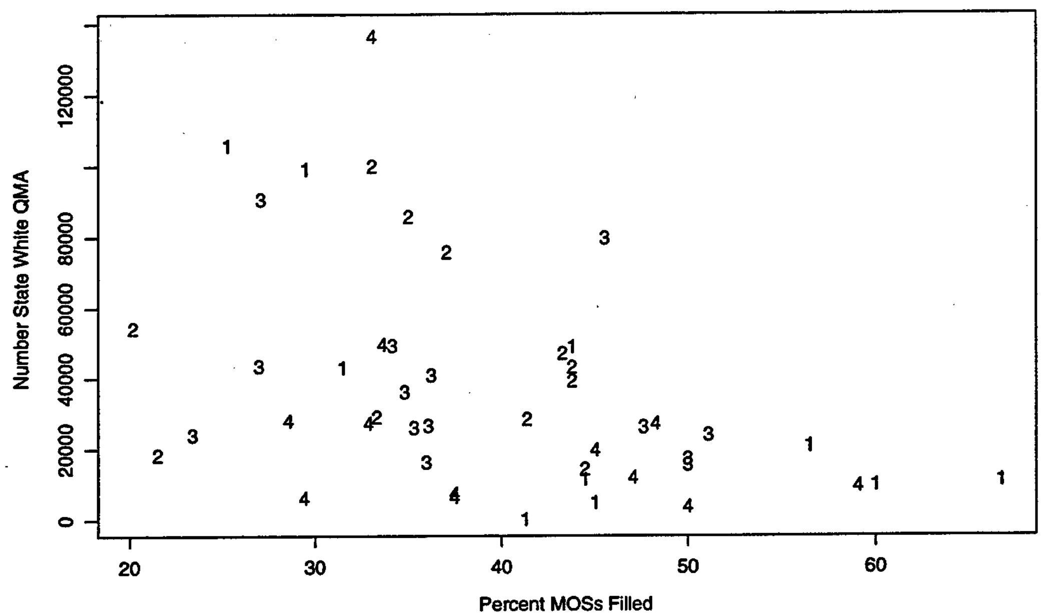
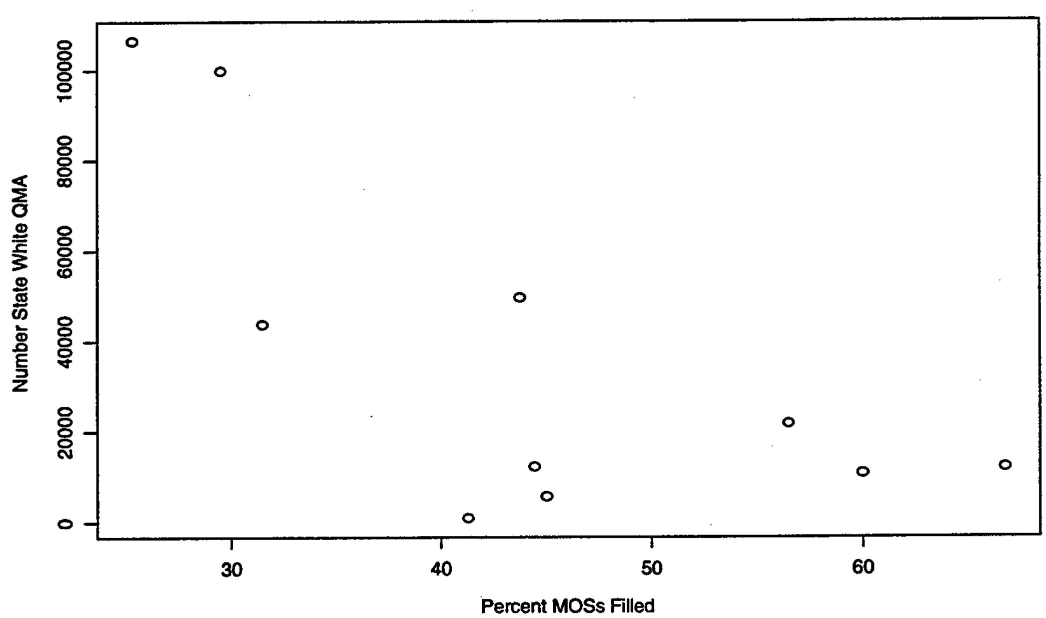


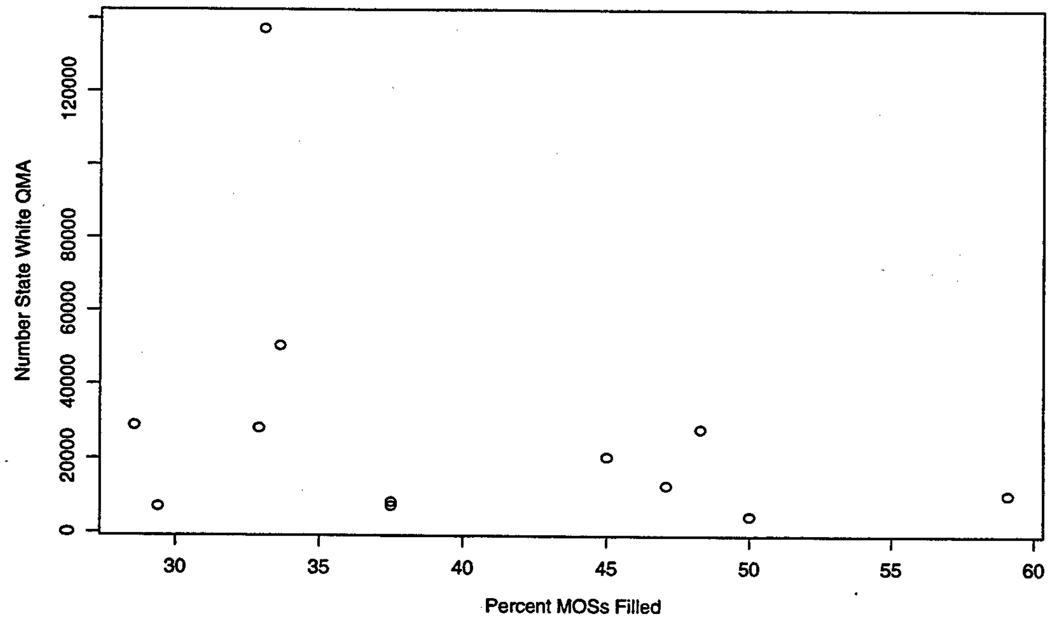
PERCENT MOSs FILLED vs NUMBER STATE WHITE QMA



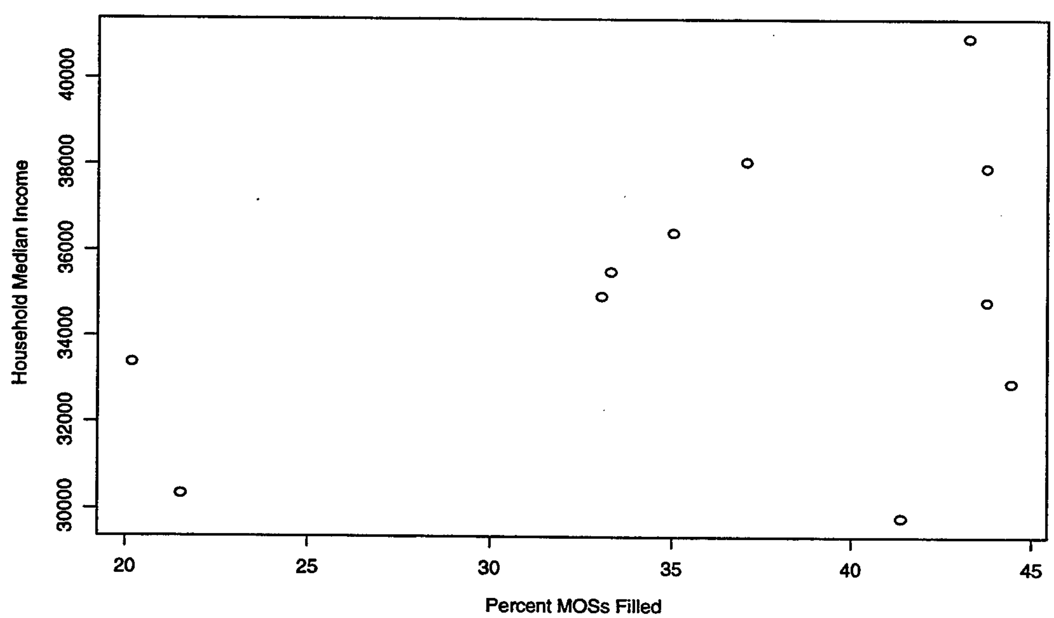
REGION 1 PERCENT MOSs FILLED vs NUMBER STATE WHITE QMA



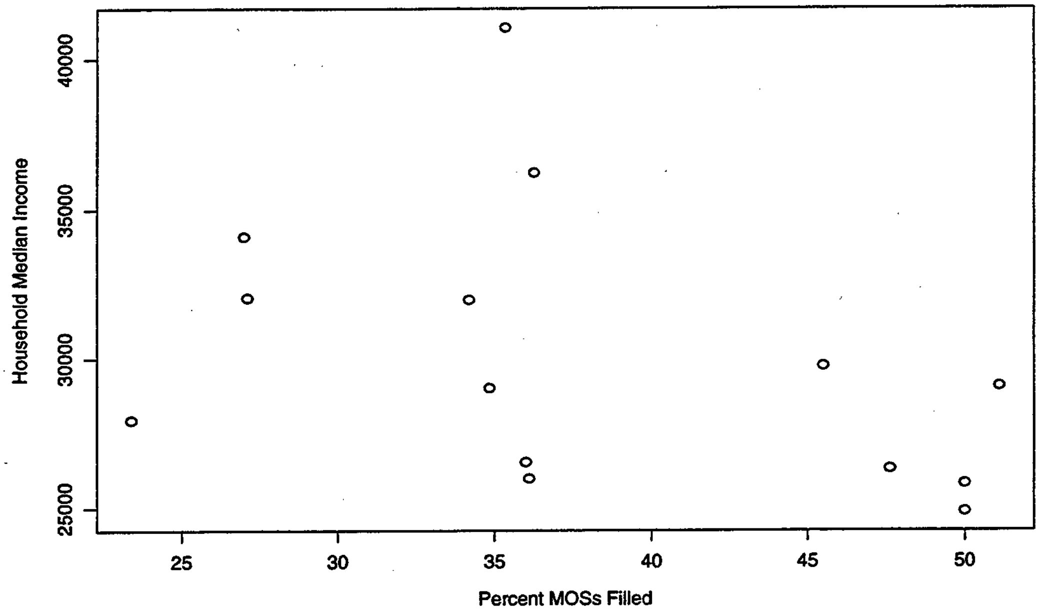
REGION 4 PERCENT MOSs FILLED vs NUMBER STATE WHITE QMA



REGION 2 PERCENT MOSs FILLED vs HOUSEHOLD MEDIAN INCOME



REGION 3 PERCENT MOSs FILLED vs HOUSEHOLD MEDIAN INCOME



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